



**Elysium
InfiPoints®**



Elysium InfiPoints Operation Manual

Vol.1. Data Pre-processing

December 2023

Elysium Co. Ltd.

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1. Elysium InfiPoints Overview

1.1. What InfiPoints Can Do

InfiPoints is a software to effectively utilize laser scanned 3D point clouds. InfiPoints supports simulation, modeling and data pre-processing of point clouds, capable of reducing time and labor for operation.

1.1.1. InfiPoints Application Examples

Check Situations of Actual Sites on Your Computer

Avoid the haste of going on-site to manually measure dimensions. InfiPoints allows smooth rendering and editing of large-scale point cloud data. You can check the condition of the site and make measurements accurately and effortlessly on your computer.



Automatically Register Point Cloud Data

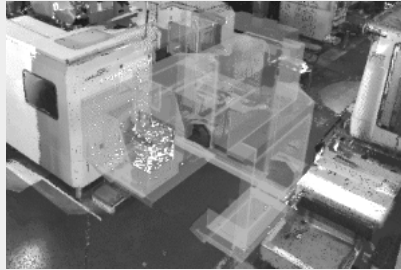
InfiPoints enables automatic registration of multiple scans. 3D laser scanning requires scanning from multiple angles and locations, and aligning them into a single data file. With automatic registration, users can substantially reduce time for manual alignment.



Digitally Simulate Equipment Emplacement Routes

Simulate emplacement routes for installing new equipment on-site.

Using both CAD models and point clouds, InfiPoints enables interference check among walls, ceilings, and objects such as existing equipment.



Automatic Modeling of Pipes and Equipment

No manual work is needed to model individual pipes and equipment.

You can automatically extract pipes and planes from point clouds and create CAD models easily.



Export 2D Working Drawings

2D working drawings can be created easily from scanned point cloud data.

2D drawings can be exported and shared with construction managers as soon as the data is pre-processed. Measurements do not have to be taken on-site anymore.

**Point
Cloud
(3D)**



**Working
Drawing
(2D)**

Create Movies

Create high quality movies from scanned point clouds.

Traveling costs for site visits can be reduced, and timely decisions can be made on-site.


**Point
Cloud
(3D)**



**Fly-through
Movie**

1.2. Frequently Asked Questions for Data Pre-Processing

1.2.1. FAQ

Question	Answer
No response since the execution began. What should I do?	<p>Please be aware that depending on the size of the point cloud data, it can take a very long time to complete the process. (In some cases, it can take up to half a day for a single process to complete.)</p> <p>Elysium is continuously enhancing the software for better performance, and therefore it is very important to keep the software up to date. Please contact Elysium customer support if there is no response for more than 20 hours.</p> <p>Please refer to 1.7.1, "Guide for Processing Time" for an estimated time of execution using the sample data.</p>
"Auto Registration" or "Noise Reduction" fails?	<p>The point cloud data may lack the necessary information to execute the process. These processes will not work with data in text and ".pts" format.</p> <p>However, they will work fine with raw data from 3D scanning such as, ".fls" files. Please note that some information could get lost from raw data if edited in other applications.</p>
It takes too long for the noise reduction?	<p>Noise reduction is parallel processed which tends to cause high memory usage. It could take time if the process consumes more memory than is available.</p> <p>Memory consumption could be reduced by changing the parallel processing settings:</p> <ul style="list-style-type: none"> • Decrease the value of [Number of used threads] at [System Settings] > [Miscellaneous]. • Please ensure that "the specified value (number of threads to use) x 8GB" is below the memory size. <div style="display: flex; align-items: center; margin-top: 10px;">  <div> <p>8GB is the recommended memory size for 40 million points or less per shot of a point cloud data. When many points exist per shot, InfiPoints may consume more memory than 8GB.</p> </div> </div> <p>*Please refer to 1.5.1, "Selecting number of threads used (Option)" for information about the number of threads.</p>

1.3. Contact Us

Please contact us for any inquiries.

Elysium Co. Ltd. Customer Support

Tel: +81-53-413-1006

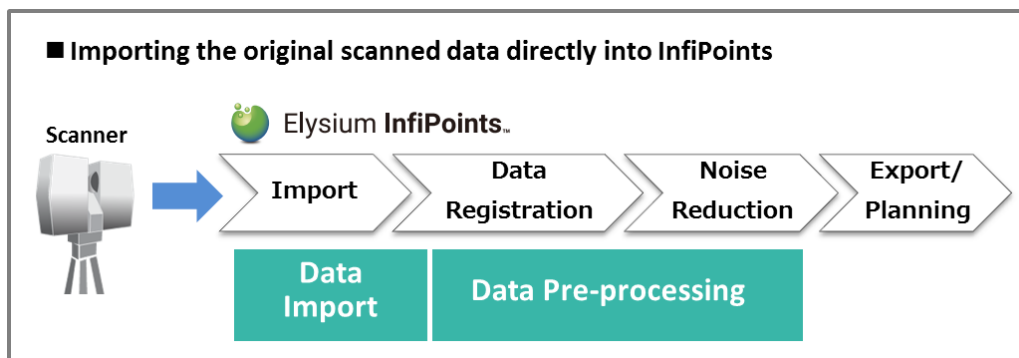
Email: infipoints@elysium.co.jp

1.4. Process Flow

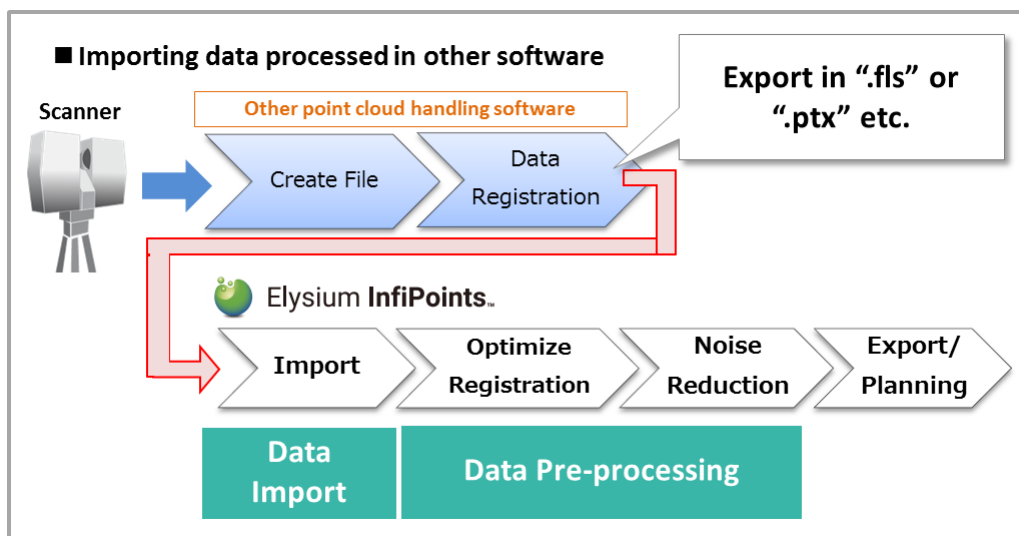
When processing point cloud data, users can first import multiple shots into the software and then align the data to create a single point cloud data file.

Removing unnecessary noise could optimize work efficiency and improve the accuracy as well.

This is called "data pre-processing."



InfiPoints can import various data formats (i.e., .fls, .zfs, .ptx) created by other point cloud processing software such as FARO SCENE, Laser Control, Cyclone, etc.



1.5. Machine Setup

1.5.1. Selecting number of threads used (Option)

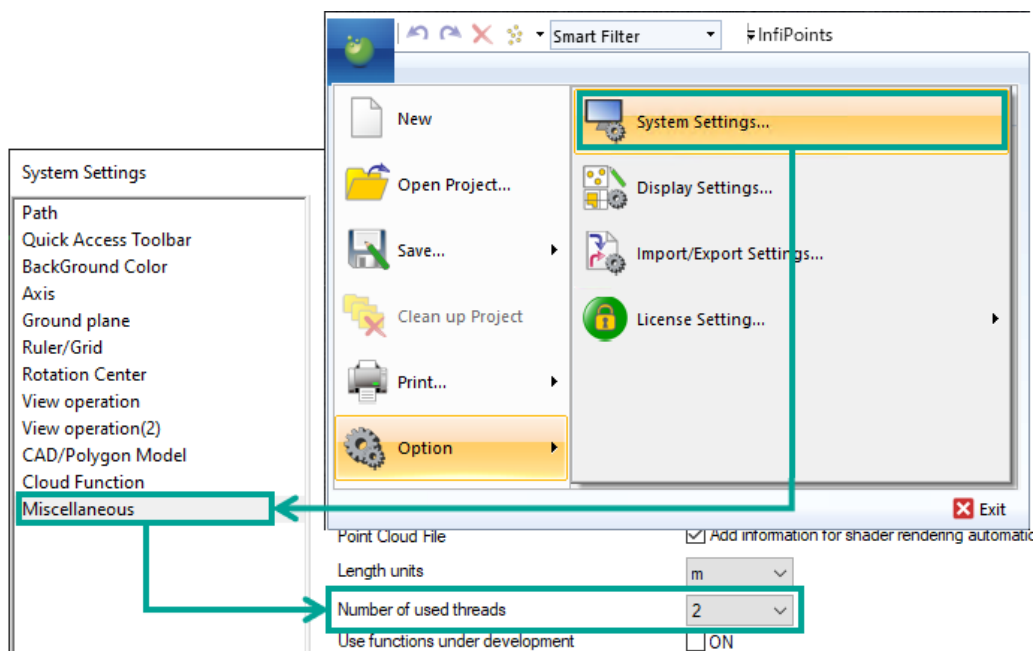
By selecting the number of threads (parallel processing) used, it is possible to shorten the processing time for data import, plane and pipe extraction, and/or noise reduction.

Setting limitations differ with each machine environment, but it is preferable to configure this setting as soon as possible for optimal performance.



Selecting the same number of threads as physical threads is recommended.

- [Application Menu] > [Option] > [System Settings] > [Miscellaneous]

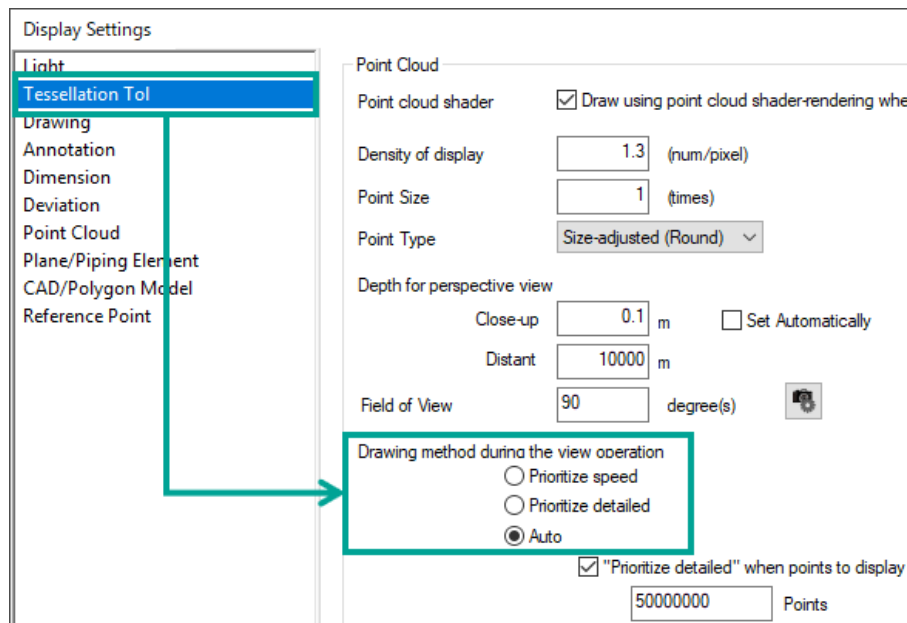


1.5.2. Maximizing rendering capability (Option)

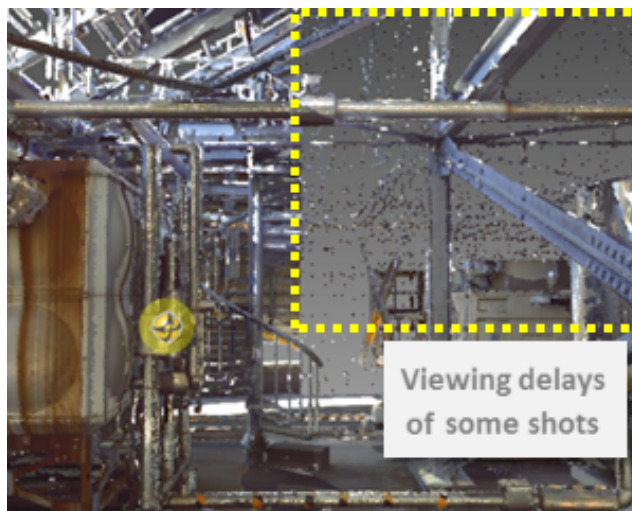
In the default setting, point clouds are thinned out for view operations to achieve high-speed rendering.

It is possible to display all point clouds without thinning, but this may slow down point cloud rendering time in some cases.

- [Application Menu] > [Option] > [Display Settings] > [Tessellation Tol]



On some machines that have video cards such as RADEON installed, point clouds may be displayed while panning, but disappear once you stop. Go to [Application Menu] > [Option] > [System Settings] and switch off [Reduce flicker during point cloud display] to avoid this problem.



1.6. Notes on Registration of Point Cloud Data

1.6.1. Points to be noted when scanning with 3D laser scanner

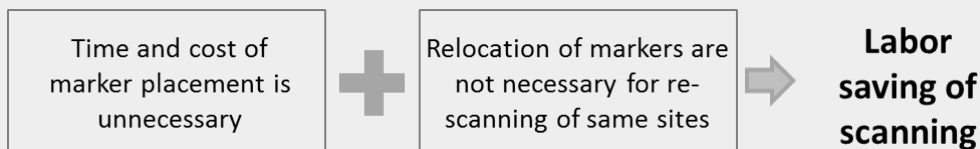
InfiPoints can automatically register point clouds without placing markers or target spheres during scanning.

Please refer below for tips on how to register point clouds without using markers.

Registration without Markers

Merits of registration without markers

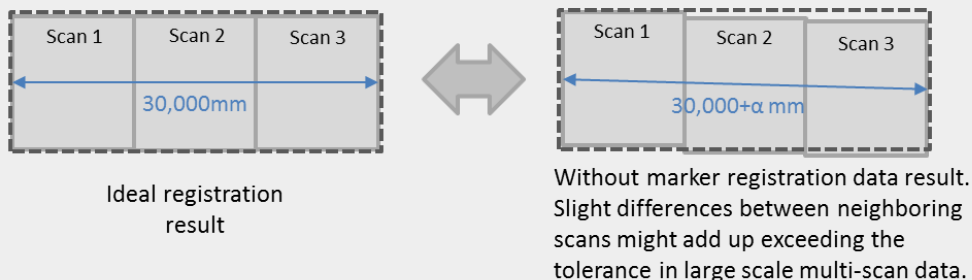
InfiPoints automatically determines the location of the shots by referring to neighboring shots in a relative manner. For this reason, InfiPoints does not require markers for registration. Also, it is not necessary to relocate markers when rescanning sites. This can reduce time and cost of placing markers.



Points to be considered when not using markers

Relatively aligned shots have small alignment errors within the scanner tolerances. Accumulation of small alignment errors when scanning large scale can cause precision error that may exceed the scanning tolerances.

- Accumulation of alignment errors without marker registration.

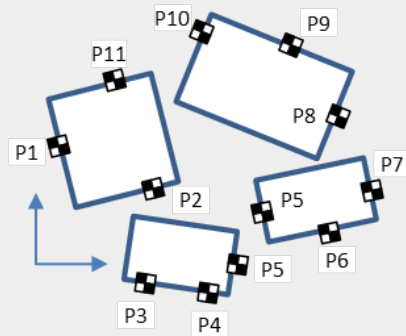


Scanning Methods in Strict Tolerance Situations

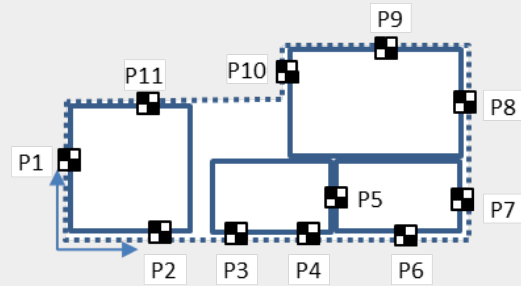
Placement of markers and use of survey instruments

Use of surveying instruments to locate marker coordinates can be helpful to meet strict tolerance requirements with large scale structures and long piping, for example. InfiPoints can import marker coordinates of shots and define their absolute location.

- Registration using marker coordinates



Use surveying instruments to locate marker coordinates along with the 360 degree laser scanner



Using marker coordinates (x,y,z), place each scan on absolute coordinate space



Create similar tolerance 3D data as traditional surveying

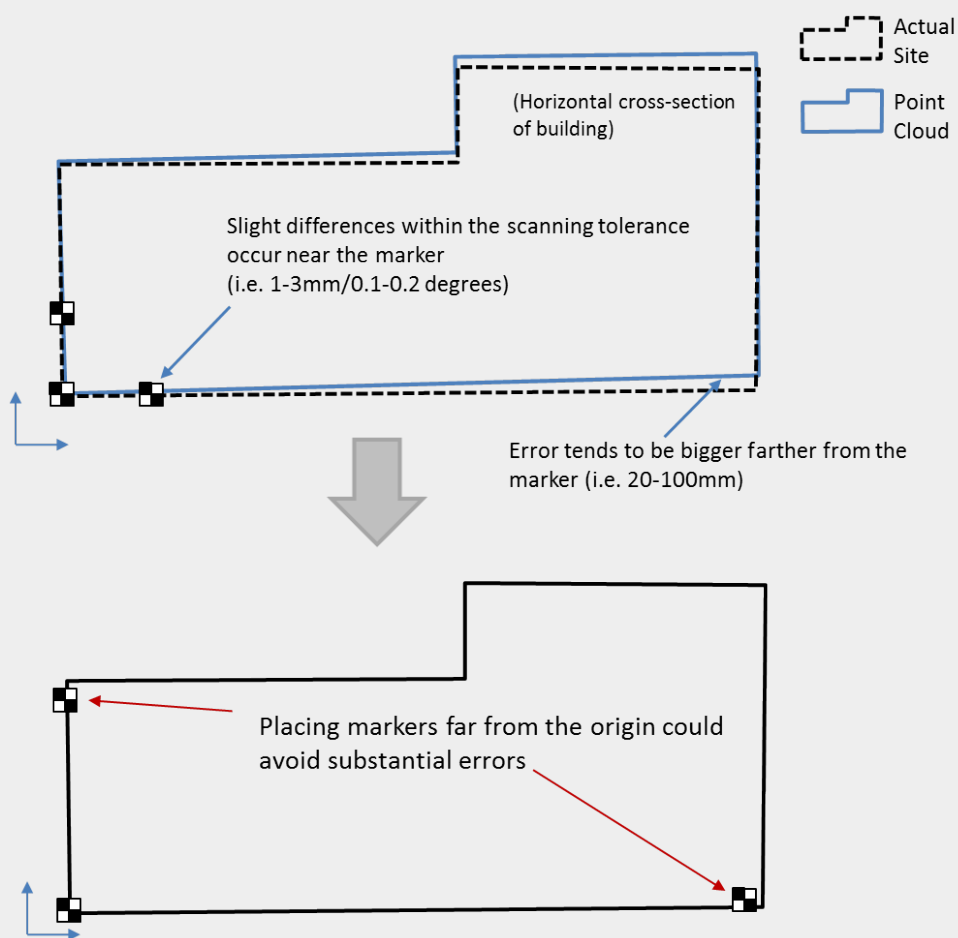
1.6.2. Marker placement effectiveness in defining global coordinate systems

It is highly effective to place markers at the time of scan to obtain accurate global coordinates when registering.

It is necessary, however, to maintain distance between markers. Markers placed too close can cause errors.

Points to be Considered When Placing Markers for Global Coordinate Definition

(Ex) Defining absolute coordinates (x,y,z values) using markers near the origin



1.7. Before Using InfiPoints

1.7.1. Guide for Processing Time

Please refer below for an estimated time guide of data pre-processing.

In this example, it took 36 min to import 8 scans with 300 million points, and perform registration, and noise reduction.

Conditions

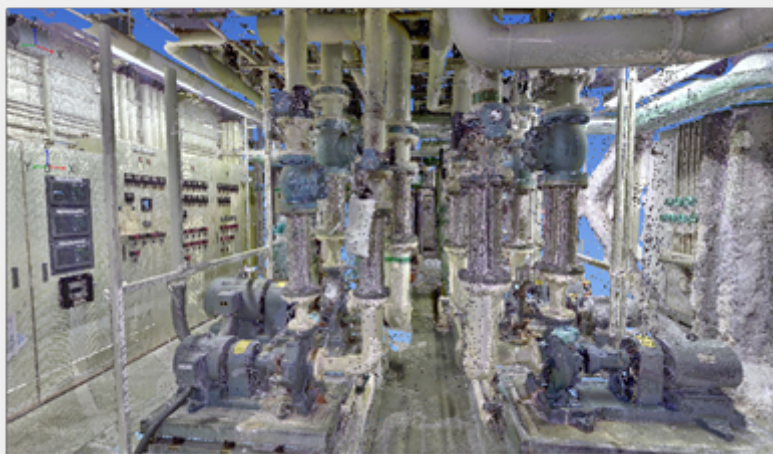
■ Data

- Scan: Indoors (Air conditioning facility)
- Scanner: FARO/Focus3D
- Data Size: 300 Million Points (Total), 40 million points x 8 scans

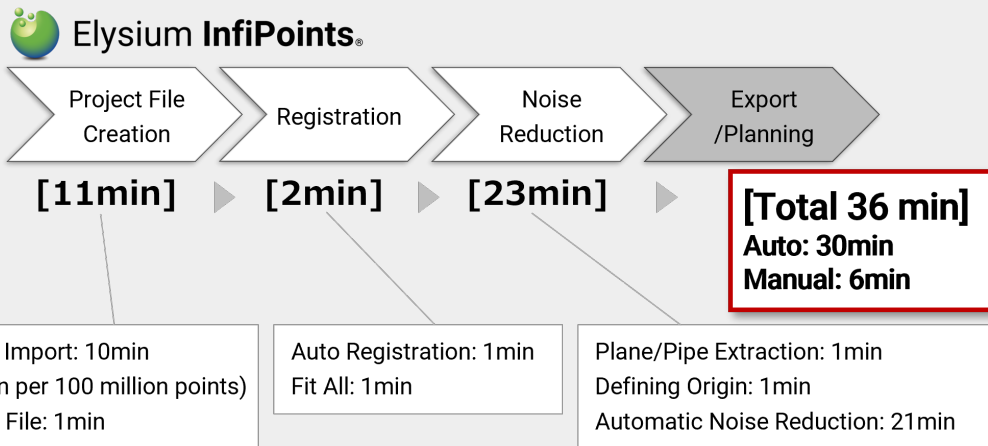
■ Processing Environment

- OS: Windows 10 64bit
- CPU: Intel Core i7-8700 (3.2 GHz)
- RAM: 32GB
- Drive: SSD
- Number of threads: 4

■ Sample Data



Processing Time Details

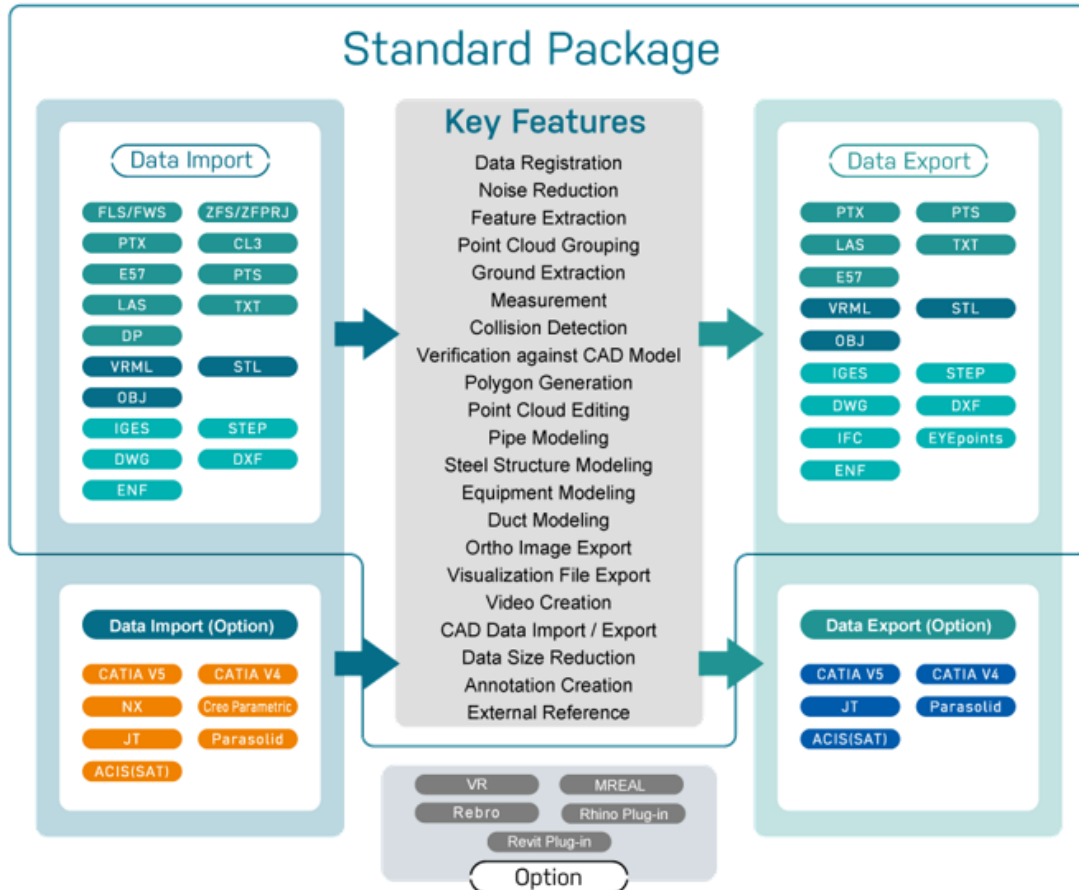


Elysium InfiPoints is basically designed to process scan shots with a resolution of 10 to 40 million points per shot. Though it is possible to process scan shots with the resolution of more than 40 million points per shot, the processing time will take longer and consume a large amount of memory in that case. Unless there is a need to use high resolution point cloud, such as the interval between scan shots are very wide, it is recommended that you use the point cloud data scanned with a resolution setting of 40 million points or less.

1.7.2. Import/Export File Formats

InfiPoints supports various file formats.

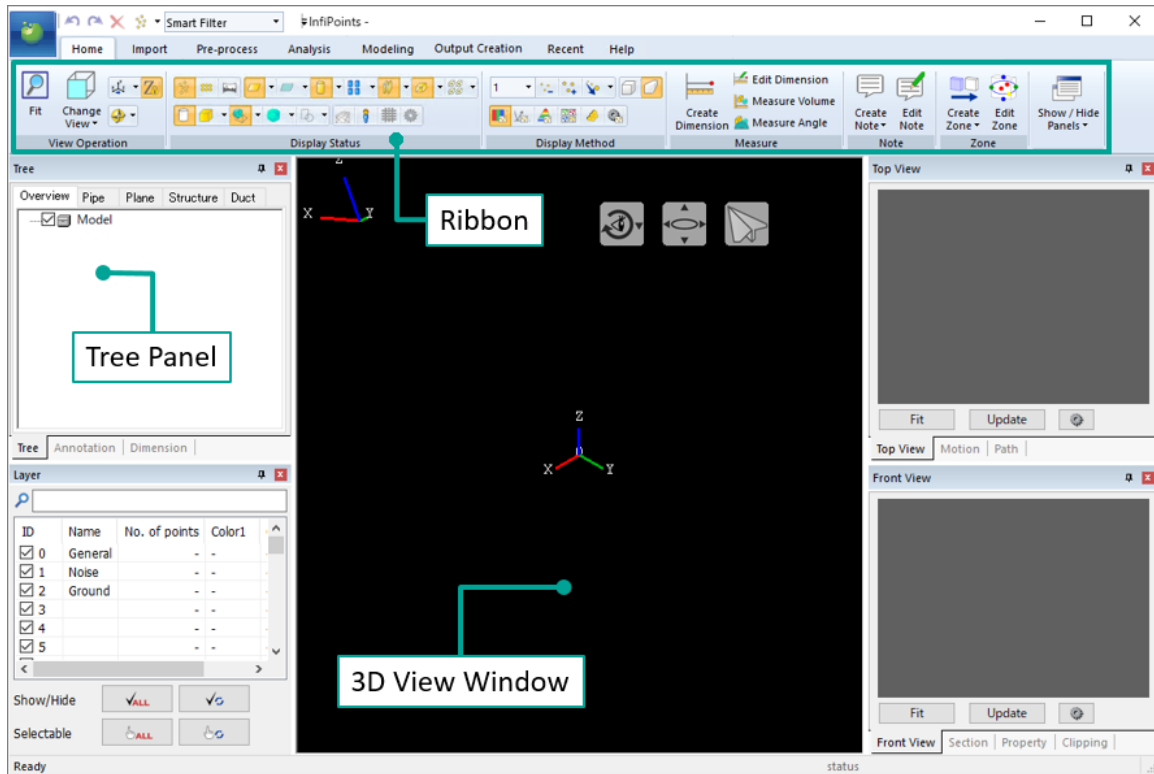
- List of supported file formats



2. View Operation

2.1. User Interface (UI)

Below is the UI of InfiPoints.

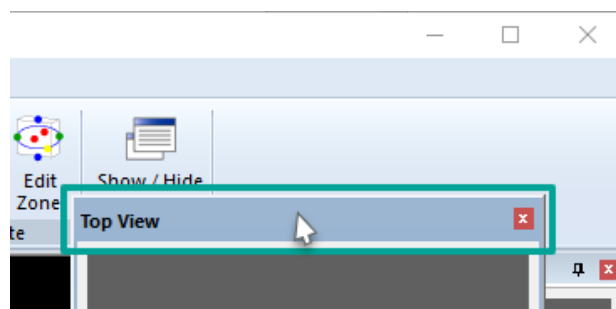


Ribbon	Displays useful icons for operation.
3D View Window	Canvas to display point clouds and CAD models
Tree Panel	Displays imported point cloud and related data (hidden in the screen shot above)

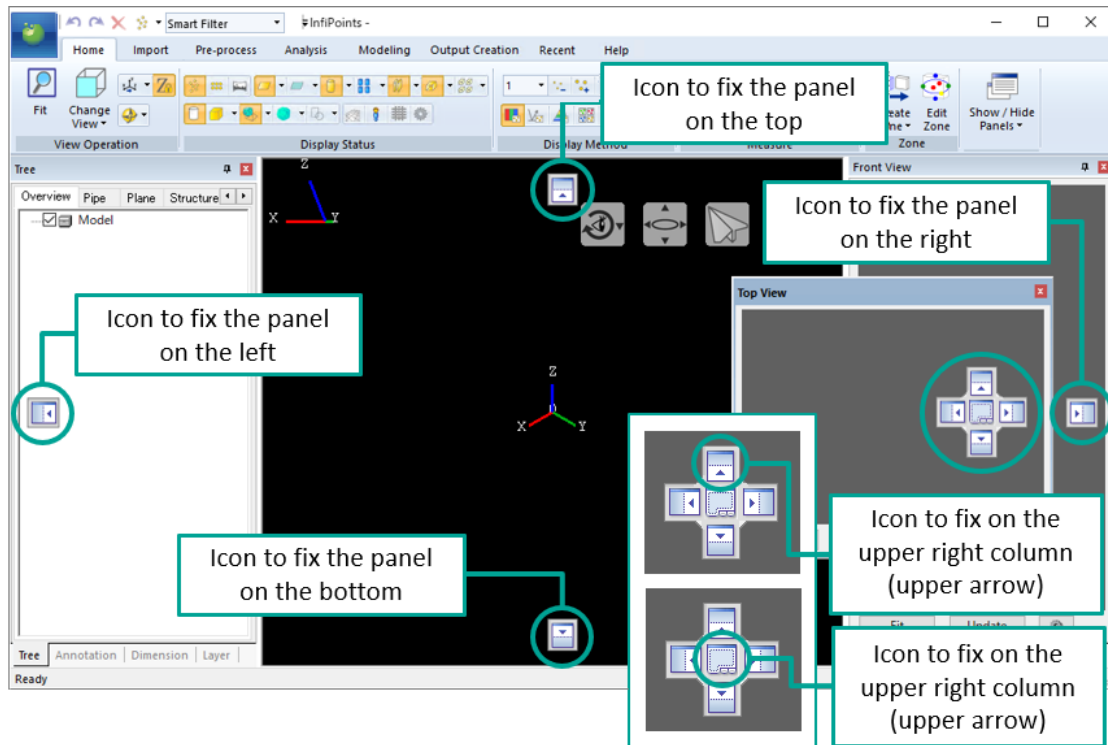
Use the [Show/Hide Panels] in the [Home] tab to show and hide panels ().

The layout of the UI can be easily customized as explained below.

1. Drag the upper part of the panel while left-clicking the mouse.



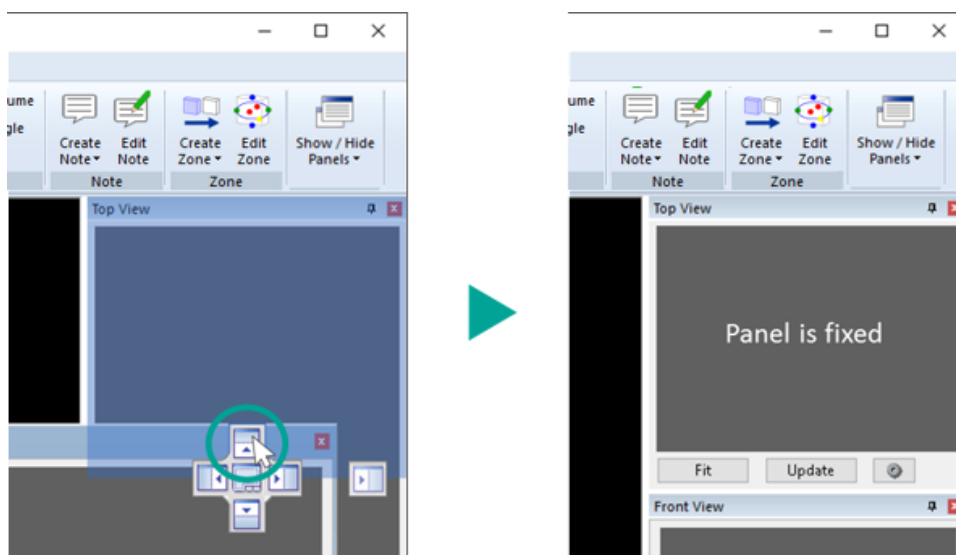
An icon to fix the panel will appear on each side of the screen.



2. Fix the position of a panel at the desired location by moving the cursor onto the icon.

(Ex.) Fixing the [Top] panel at the top right column


1. Left-click at the upper part of the [Top] panel
2. Drag the panel to the icon (Area to be fixed will be highlighted blue)
3. Release left click

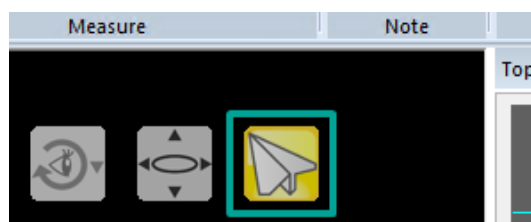



2.2. View Operation

2.2.1. Viewing Mode

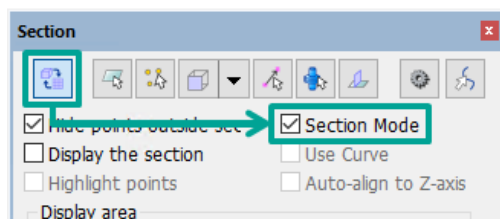
There are three viewing modes in InfiPoints.




- Normal Mode: 3D display / Move the view
- Fly-through Mode: 3D display / Move the viewpoint
- Section Mode: 2D display / View section from the front, or Clipping Box from the top/front
 - Pressing [Enable/Disable Fly-through View] () on the upper right corner of "3D View" window will switch to fly-through mode.



Fly-through speed can be changed using the [Display Speed Control] button().







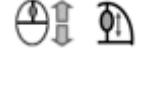













- When "Section Mode" is enabled in either [Section] panel or [Clipping] panel, the mode will switch to Section Mode.



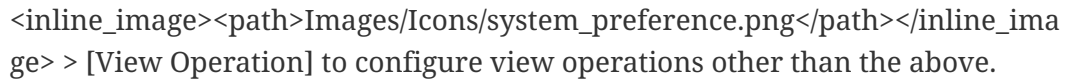
Mode	Description	Projection type	Icon
Default Mode	Movement by moving the model	Ortho View Mode	
		Perspective View Mode	
Fly-through View Mode	Movement by moving the viewpoint	Perspective Mode only	
Section Mode	Switch to 2D front view of the selected section	-	-

2.2.2. Mouse Operation

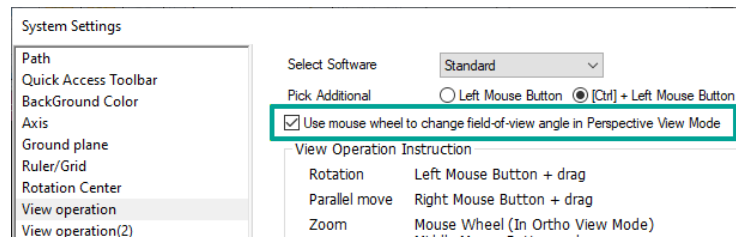
Operations below can be performed in the 3D View Window.

Operation	Description	Normal mode	Fly-through mode	Section mode
Rotate 3D	Rotate the view by moving the mouse	 (Screen center)	 (Screen center)	-
Rotate 2D Z	Rotate model two dimensionally	 (window top)	-	-
Rotate 2D Y	Rotate model crosswise	 (window bottom)	-	-
Rotate 2D X	Rotate model endwise	 (window side)	-	-
Zoom in/out	Zoom the view with the mouse movement (Zoom will move forward and backward without changing the vertical direction height)			
Pan	Move model parallel			
Field of view	Change the field of view	- (*1)	- (*1)	-
Fix rotation center	Set the rotation center	[Ctrl]+ 	[Ctrl]+ 	[Ctrl]+ 
Select				
Area selection		[Ctrl]+ 	[Ctrl]+ 	

Select [Application Menu] > [Option] > [System Settings]

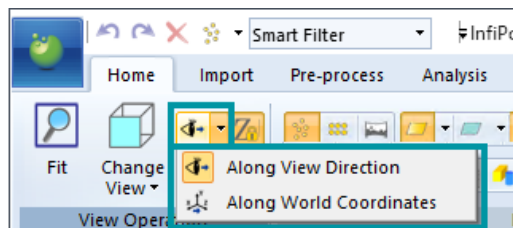
 > [View Operation] to configure view operations other than the above.



*1: Check "Use mouse wheel to change field-of-view angle in Perspective View Mode" option in [View Operation] tab to use the mouse wheel to change the field-of-view angle when in normal / Fly-through mode. The mouse wheel will be used in the same way as in "[Panoramic View](#)".



■ Normal Mode / Fly-through Mode

- Pan/Zoom direction can be changed in [Default Mode] and [Fly-through Mode].




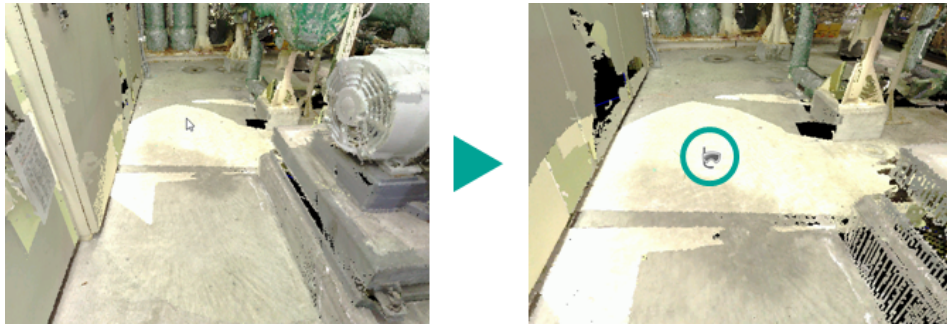
 Along View Direction	Pan/zoom " along view direction "
 Along Z-axis	Pan/zoom " along z-axis "

• View Operation Using the Mouse


- Zoom in: Move the mouse forward while holding down the mouse wheel (the middle button).
- Zoom out: Move the mouse backward while holding down the mouse wheel (the middle button).
- Pan: Move the mouse while holding down the mouse right button.

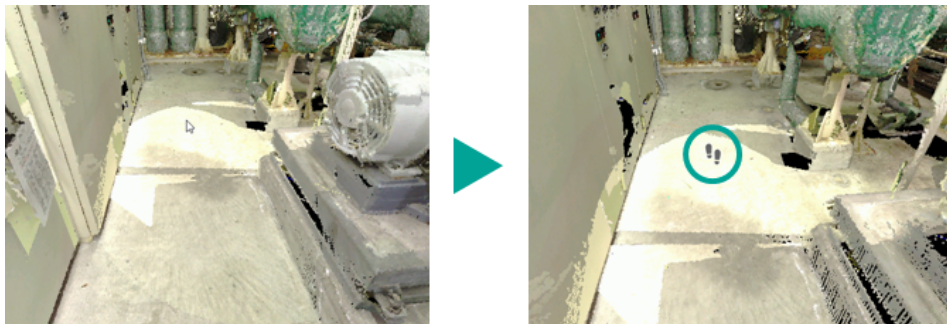
■ With "Along View Direction" Option

With the image below as an example, with "Along View Direction" option, the view direction is towards the floor, and you will get closer to the floor as you zoom in.  will be shown in "3D View" window during the view operation.




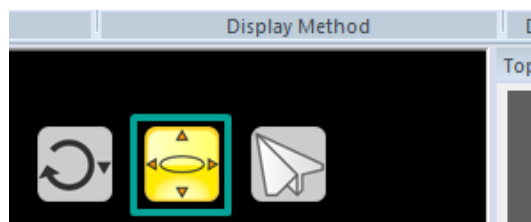
■ With "Along Z-axis" Option

With the image below as an example, with "Along Z-axis" option, the view direction is towards the floor, and you will move forward/backward along the world coordinate axes with the view direction fixed.  will be shown in "3D View" window during the view operation.

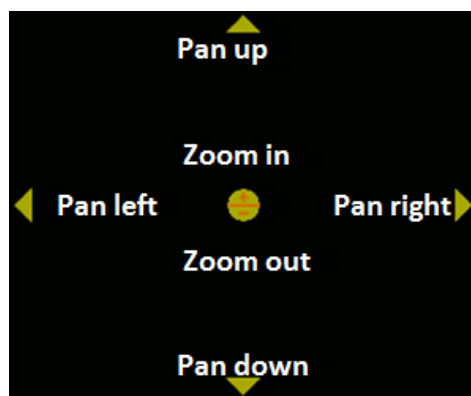


• View Operation Using the Handles

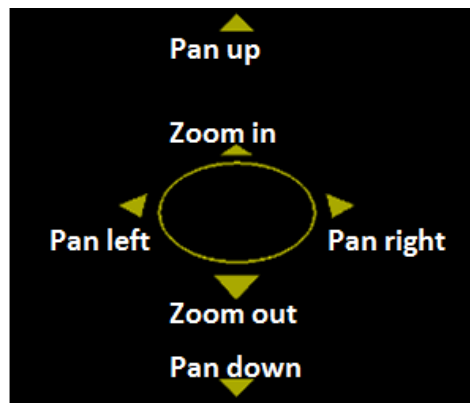
- Press [Show/Hide Handle for View Operation] () at the upper right of "3D View" window.




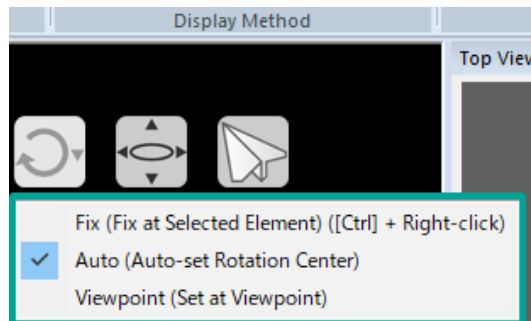
■ ■ With "Along View Direction" Option






■ With "Along Z-axis" Option





- Set Rotation Center
 - Specify the rotation center in "3D View" window.
 - Press [Fix Rotation Center] () at the upper right of "3D View" window.



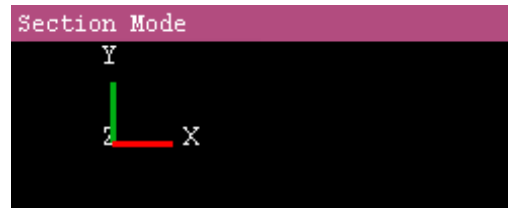
 Fix (Fix at Selected Element) ([Ctrl] + Right-click)	Set the selected object at the rotation center
 Auto (Auto-set Rotation Center)	Automatically set the rotation center at the center area of the 3D View Window
 Viewpoint (Set at Viewpoint)	Set rotation center at viewpoint

■ Section Mode

Operation	Description	Section mode
 Zoom	To zoom in/out.	<ul style="list-style-type: none"> • Move the mouse wheel forward/backward. • Drag while holding down mouse left + right buttons. Drag downward to zoom in, and upward to zoom out.
 Pan	To pan left/right/up/down.	<ul style="list-style-type: none"> • Right-drag.



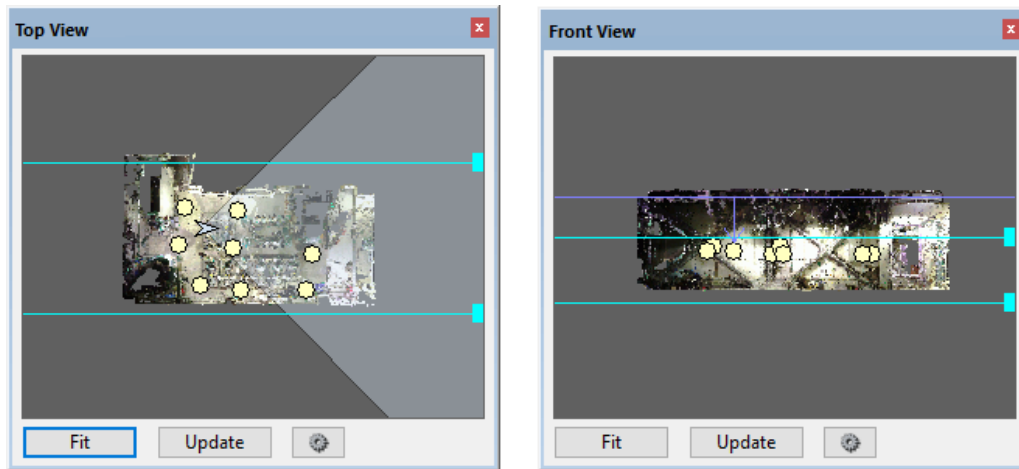
- Purple bar is displayed at the top of "3D View" window when you are in Section Mode.



- Please note that 3D rotation is not available in Section Mode.

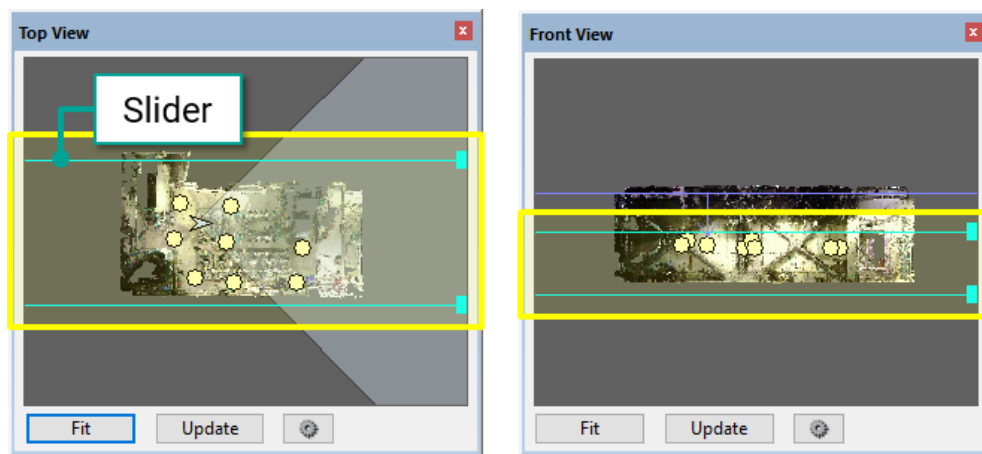
2.2.3. View Operation Using 2D Layout View

This section explains the view operation in [Top View]/[Front View] panels.



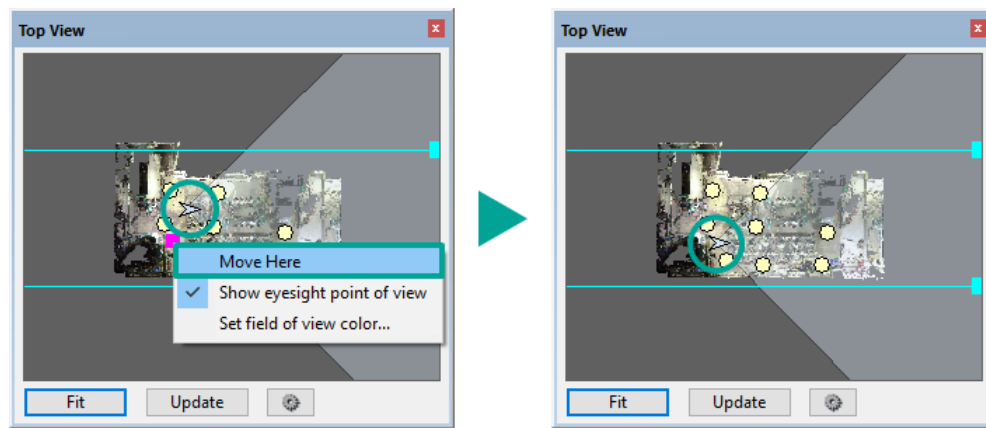
- Zoom in/out: Move the mouse wheel forward/backward in [Top View]/[Front View] panel.
- Pan: Right-drag.
- The blue sliders in [Top View] panel is to control the display range of [Front View] panel, and vice versa.

This is useful to increase the ease of manual registration in [Top View]/[Front View] panels.

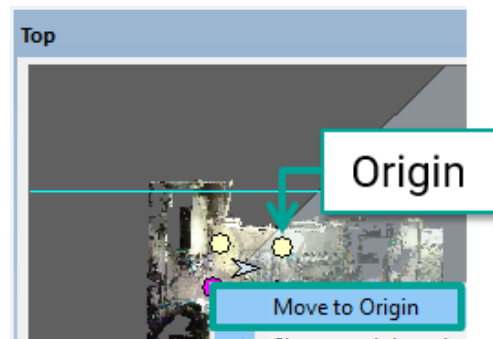


- The display range of [Top View]/[Front View] panel will be updated as you move the blue sliders.

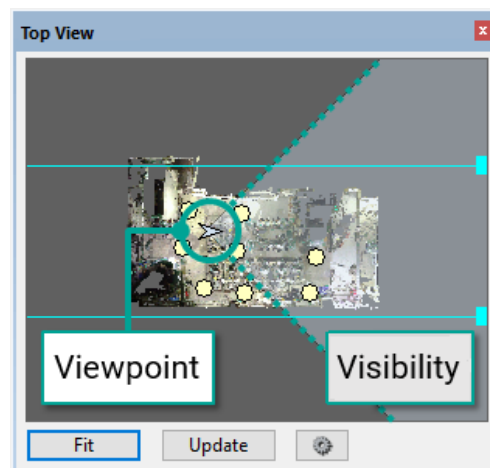
- Right-click in [Top View]/[Front View] panel, and select [Move Here] from the context menu to move the viewpoint in "3D View" window to the clicked location.



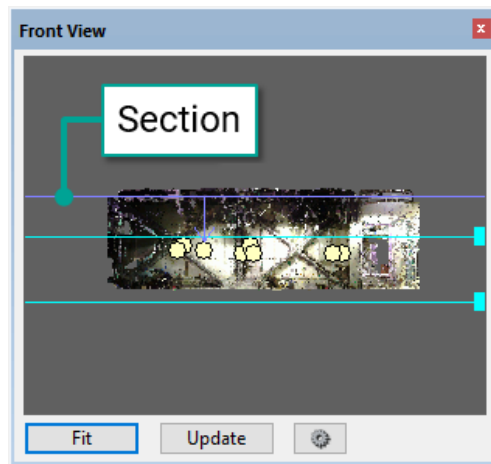
Right-click on a scanner position in [Top View]/[Front View] panel, and select [Move to Origin] from the context menu to move the viewpoint in "3D View" window to the selected local origin.



- [Top View] panel shows the viewpoint, and the field-of-view area of "3D View" window.

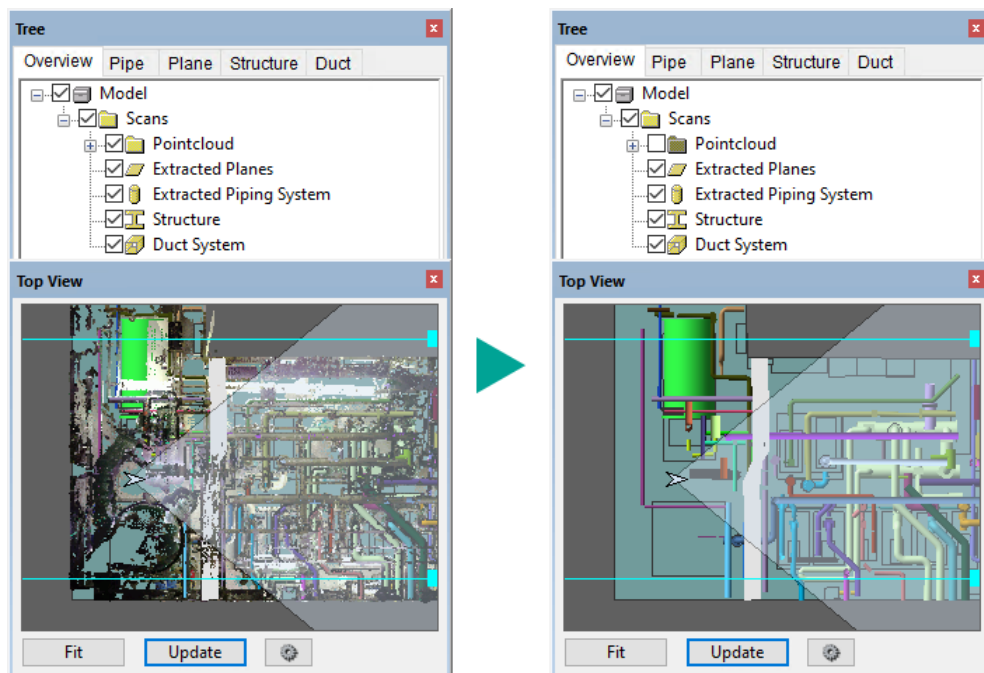


- [Top View]/[Front View] panels show the section / Clipping Box. /ifdef::help-en[They also allow the rough creation of the section / Clipping Box with a whole picture of the project. +]
To adjust the location and/or the size of the existing section / Clipping Box, use [Section]/[Clipping] panel and/or "3D View" window.



Please note that the section / Clipping Box may be shown in either of [Top View]/[Front View] panel only depending on the created location, operation, etc.

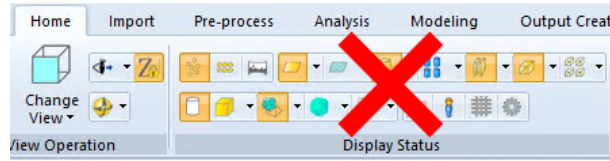
- Show/Hide status of elements in [Top View]/[Front View] panels is based on that set in [Tree] panel. Element(s)/Group(s) shown in [Tree] panel are shown in [Top View]/[Front View] panels, and element(s)/group(s) hidden in [Tree] panel are hidden in [Top View]/[Front View] panels.



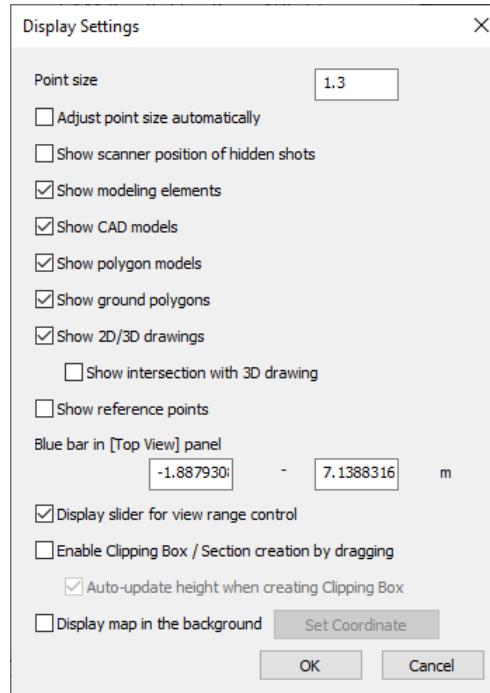
Click [Update] in [Top View]/[Front View] panel to reflect the changes made in "3D View" window and/or other panels when the view update is delayed.



Please note that "Show/Hide" commands in [Home] tab > [Display Status] category are to show/hide elements in "3D View" window per element category, and do not affect the display in [Top View]/[Front View] panels.



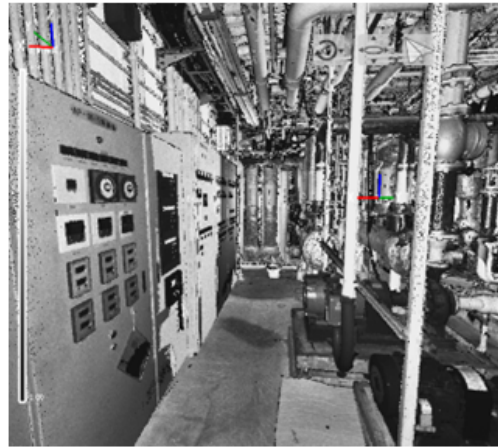
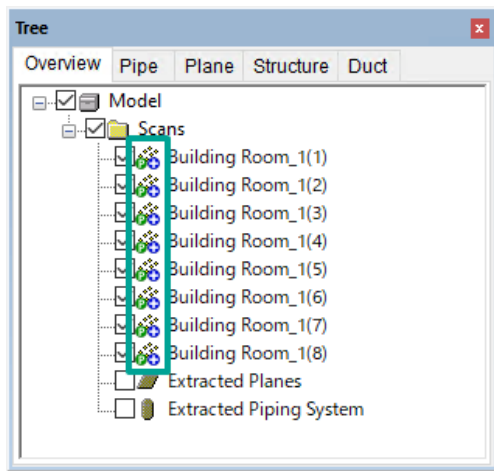
- Click  in [Top View]/[Front View] panel to edit the display settings of each panel.



Please note that the display settings of [Top View]/[Front View] panels are independent from each other. Set options independently as appropriate.

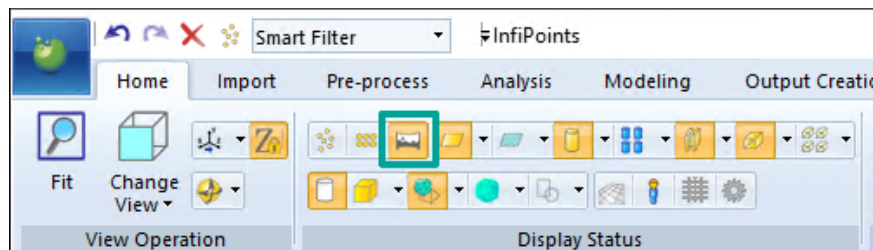
2.2.4. View Operation in Panoramic View

This section explains the view operation in Panoramic View. Panoramic View is available on the projects which contain scan shots that have scan index, and the photos from the scanner.



P on the icon in [Tree (Overview)] panel indicates that the corresponding scan shot contains the photos from the scanner.

- Select [Home] tab > [Switch to Panoramic View] () from the ribbon menu.

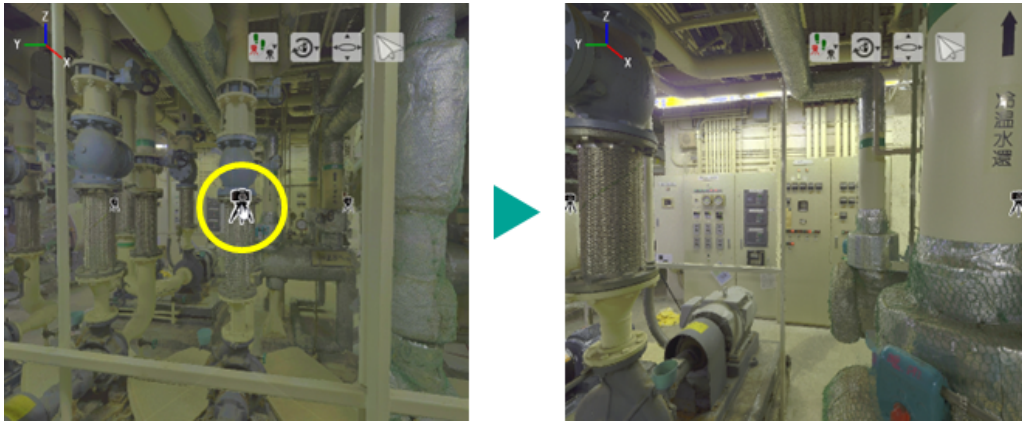


"3D View" window will switch to Panoramic View.

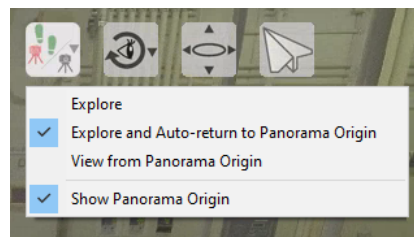





■ Panoramic View

Click a scanner position () to move the viewpoint to the selected panorama origin.



- To switch the view operation method in Panoramic View
 - Select how the view behaves to the view operation.





 Explore	Drag while holding down the mouse wheel or the mouse middle button to move the viewpoint forward/backward.
 Explore and Auto-return to Panorama Origin	Drag while holding down the mouse wheel or the mouse middle button to move the viewpoint forward/backward. Release the mouse wheel or the mouse middle button, and the viewpoint will move to the nearest panorama origin.
 View from Panorama Origin	Select a panorama origin in "3D View" window, and the viewpoint will move to it. The viewpoint is fixed at the selected panorama origin.



Disable [Show Panorama Origin] to hide the scanner positions in "3D View" window.

- View Operation Using the Mouse

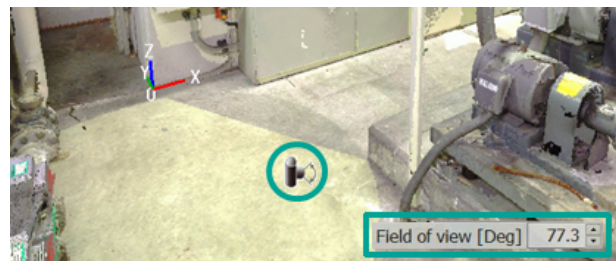
Operation	Description	Panoramic view
 Field of view	Change the field-of-view angle.	


Operation	Description	Panoramic view
 Zoom	Zoom the view with the mouse movement (Zoom will move forward and backward without changing the vertical direction height)	

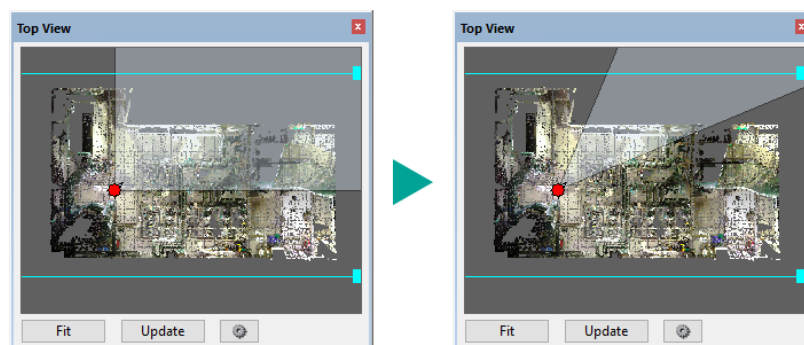
■ Field of View

Move the mouse wheel in "3D View" window to change the field-of-view angle in Panoramic View.

- Move the mouse wheel forward to increase the field-of-view angle.
- Move the mouse wheel backward to decrease the field-of-view angle.



-  icon will appear in "3D View" window when changing the field-of-view angle.
- Move the mouse wheel, and [Field of view [Deg]] field will also appear in "3D View" window. Specify the value in the field to change the field-of-view angle.
- The field-of-view angle is shown in [Top View]/[Front View] panels. (Left: Field-of-view angle is 90 degrees. / Right: Field-of-view angle is 45 degrees.)



3. Create Project Data


3.1. Importing 3D Scanned Data

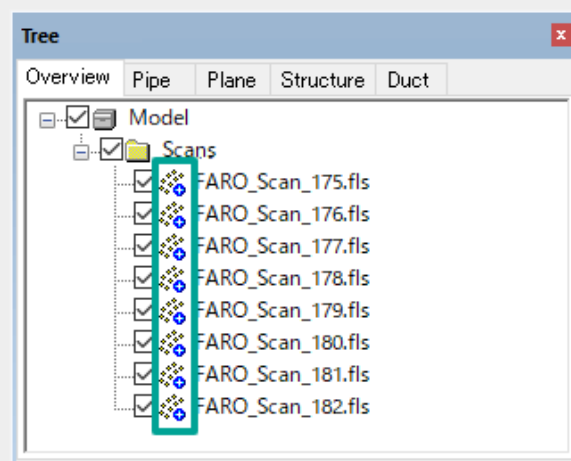
Import 3D laser scanned data and point cloud data created in other software into InfiPoints.

Types of Point Cloud File

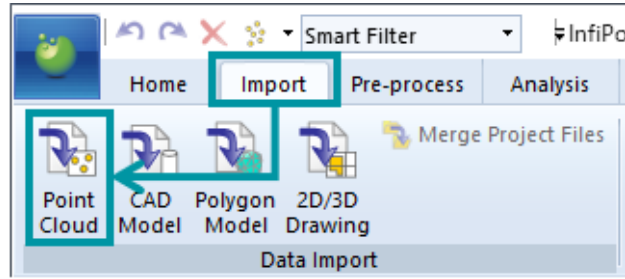
- With Elysium InfiPoints, it is recommended that you use point cloud files with scan index data (*1).
(*1) At Elysium, "Scan index data" refers to the measurement position of the scanned data, and the array information of the point cloud.
- For point cloud files that do not have scan index data, InfiPoints cannot perform auto registration or noise removal.
- Below are the formats of Point Cloud data that contains scan index data.
 - fls (FARO)
 - zfs (Z+F)
 - ptx (Leica, etc.)
 - dp (Dot Product)
 - E57 (*2)

(*2) Whether or not the E57 has scan index data depends on the software you used for pre-processing.

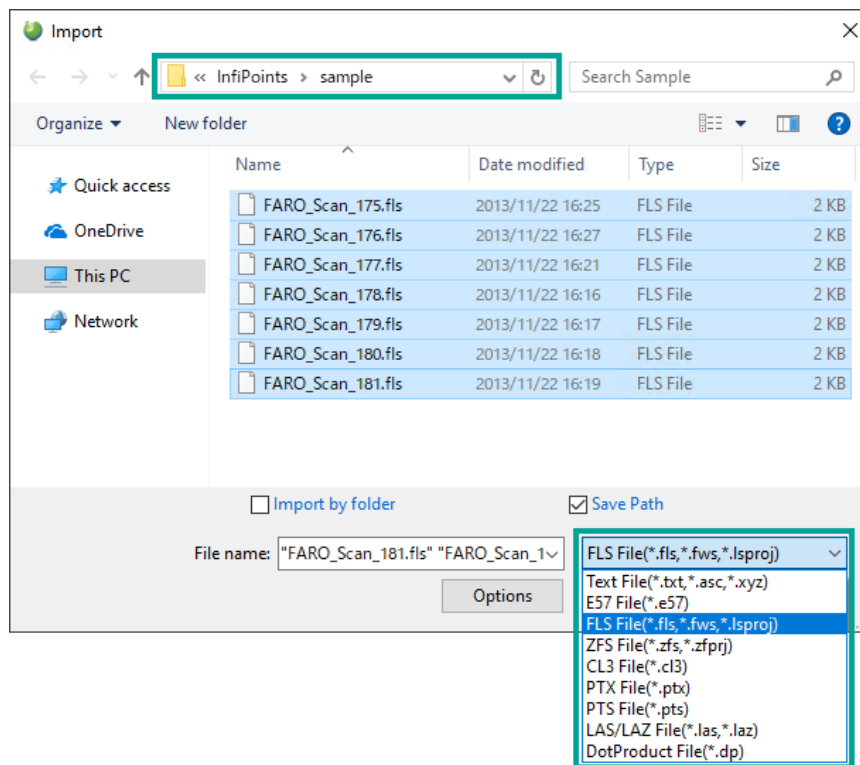
- After importing a point cloud file into InfiPoints, the imported point cloud file will appear on the structure tree in [Tree (Overview)] panel. For the point cloud file with scan index data, a plus mark () is displayed next to each point cloud part under the "Scans" folder in [Tree (Overview)] panel.



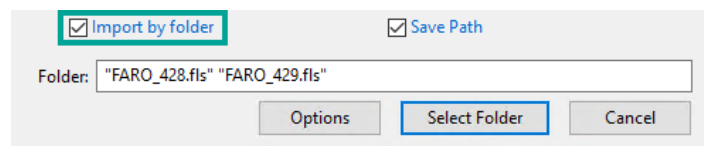
1. Press [Import] tab > [Point Cloud] () from the ribbon menu.



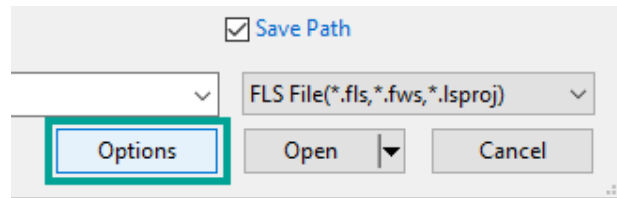
2. Import dialog will appear. Specify the file extension and select point cloud data files to import. (e.g., "*.fls" for FARO 3D scanners)



- Multiple files can be selected by holding the [Shift] key or the [Ctrl] key.
- Point cloud data can be imported by drag-and-drop as well.
- In "Import" dialog, enable "Import by folder" to switch to the folder selection dialog.

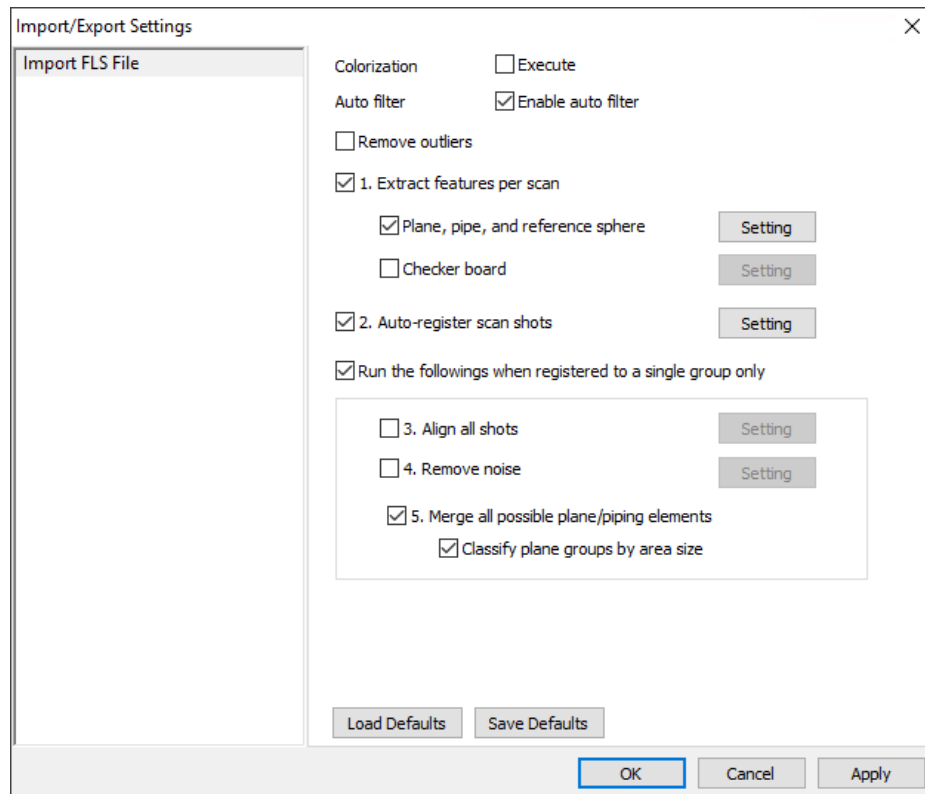


3. Click [Options] in "Import" dialog.

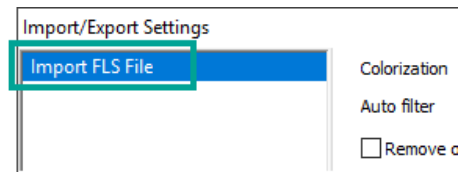


Import/Export Settings dialog will appear.

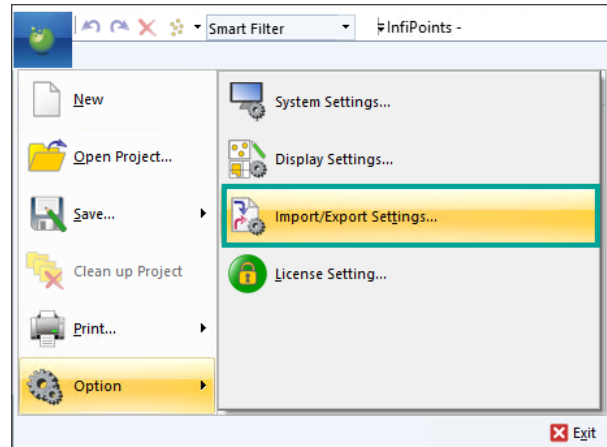
Users can also choose to automatically extract planes and pipes while importing the point cloud.



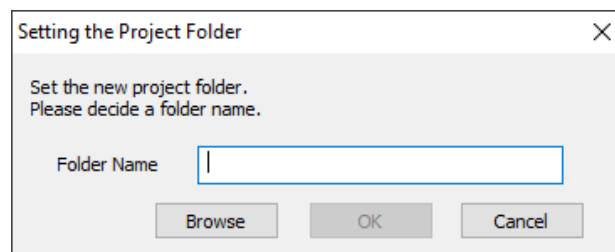
You can configure import/export options for the file type corresponding to the specified file extension.



Options are also configurable from [Application Menu] > [Option] > [Import/Export Settings].



4. Click [OK] in the file settings dialog.
5. Click [Open] in "Import" dialog. "Setting the Project Folder" dialog will appear.

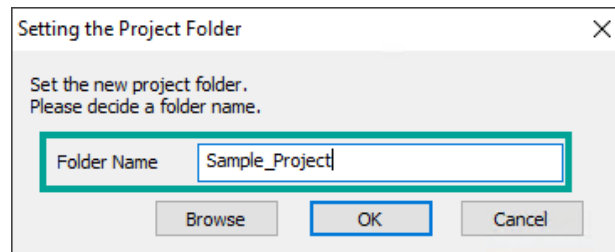


Please refer to [3.2, "Saving Projects"](#) for the settings of Project folders.

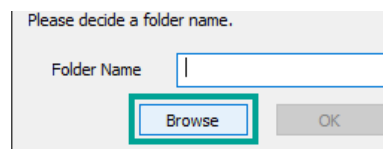
3.2. Saving Projects

InfiPoints work data is saved as project file.

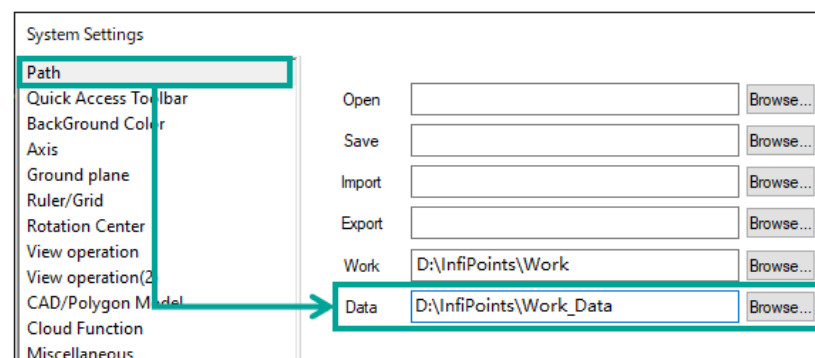
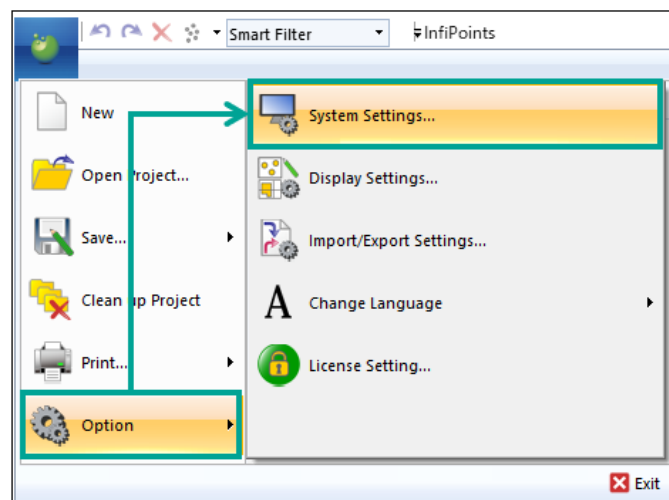
1. In "Setting the Project Folder" dialog, set the project folder (Work folder) name and click [OK].



- Click [Browse] to select the folder that will be used to save project files.

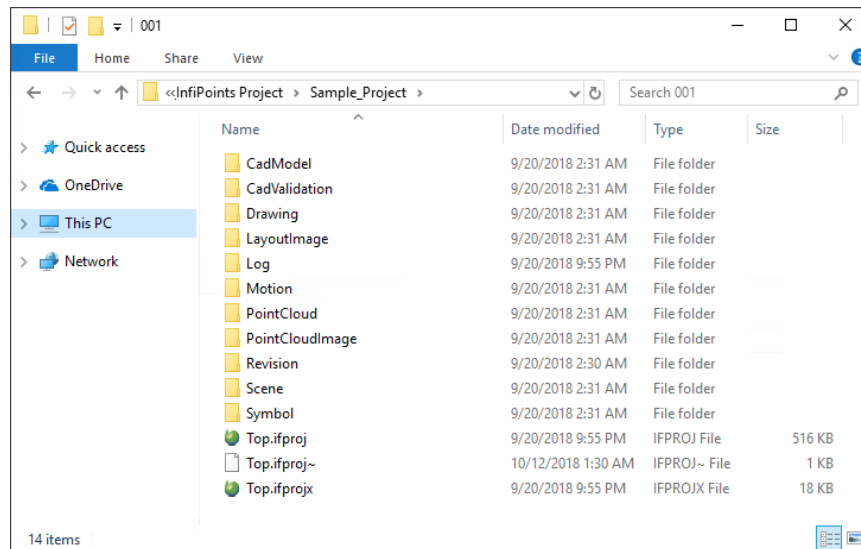


- The save location which appears when you click [Browse] can be set in [Application Menu] > [Option] > [System Settings] > [Path].



Project folder will be created in the Data folder.

All the project data such as drawings and 3D objects which will be created in the later process will be saved in the project folder as well as imported point cloud data.



[Work] or [Data] directories cannot be set in root folders such as C:\ or D:\.

[Data] folder cannot be set within the [Work] folder. Also, [Work] folder cannot be set within the [Data] folder.

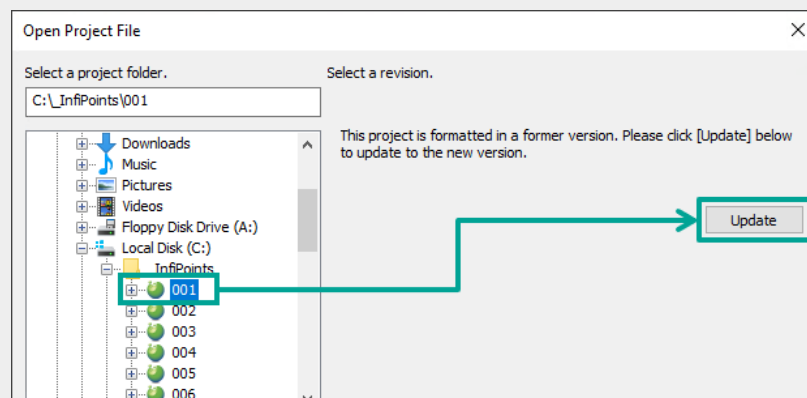
Updating Projects in Former Format


Projects saved in InfiPoints Ver.4.1.4 or former cannot be opened in Ver.5.0 or later as they are. You need to migrate the projects from the former format to the new format.



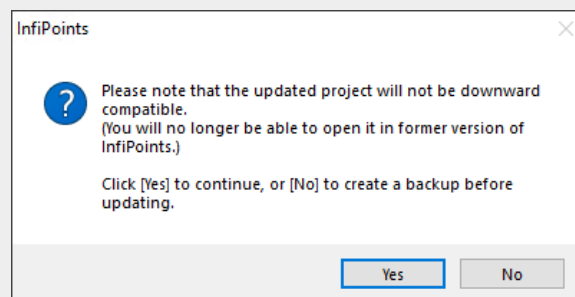
Please note that you can no longer open updated projects in InfiPoints Ver.4.1.4 or former. So it is recommended to create a backup before you start updating the project in case you may need to work in InfiPoints Ver.4.1.4 or former as well.

1. On the left list of "Open Project File" dialog, specify the project folder created in InfiPoints 4.1.4 or former, and click [Update] on the right.

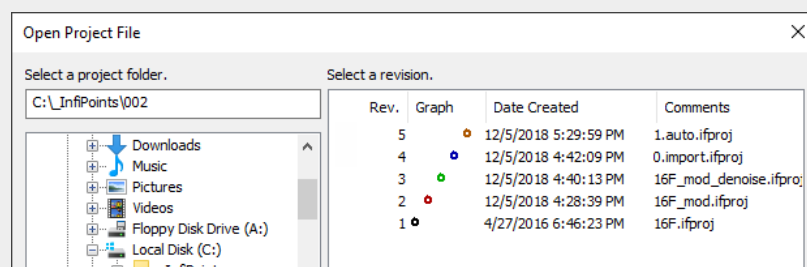


"Open Project File" dialog can be displayed by clicking [Open Project] ().

Click [Yes] in the following dialog to start migration to the new format project file.



2. The revision list will appear in the right pane once the update is complete.



4. Registration

4.1. Registration

When scanning from multiple locations, it was originally customary to place target markers beforehand and use them for point cloud registration. When registering with InfiPoints, it is possible to perform the registration without the target markers. When target markers are used, there are also functions to use the information for registration.

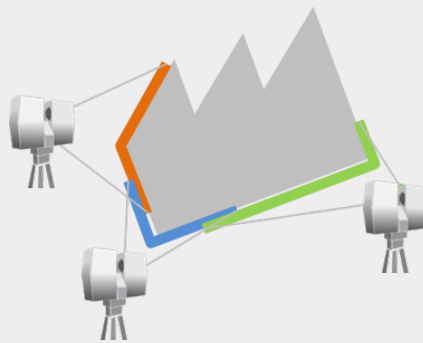
4.1.1. Registration Using InfiPoints

What is Registration?

Registration of point cloud refers to the relative alignment of 3D scans taken from multiple locations.



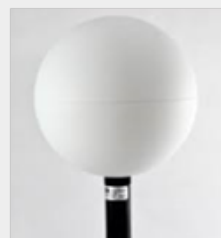
"Registration" is also referred to as "alignment."



About Target Marker

InfiPoints is capable of registering 3D point clouds with or without target markers (picture below on the right) or surveyed coordinates.

Registration methods are explained below.

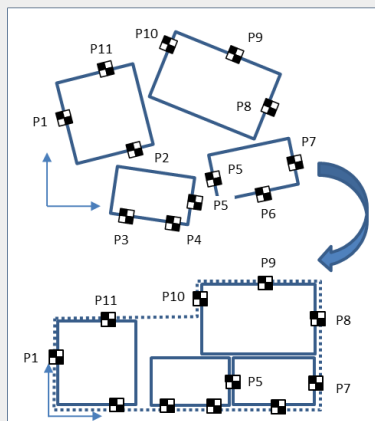


3D coordinate information acquired from devices such as Total Station, independent from 3D laser scanner.

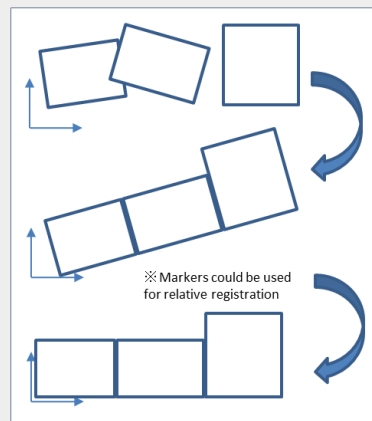
With/Without Markers & Registration Methods

Marker	Survey	Registration Method	Merit	Demerit
Yes	Yes	Method 1: Using surveyed coordinates	<u>Minimize measurement error</u> against the real object (within the survey tolerance)	<u>Working time would be longer</u> as surveying is needed, equipment needed
	No	Method 2: Relative alignment + Defining coordinates	<u>Short on-site work time</u> as survey would not have to be done	<u>Measurement error could add up</u> with multiscan registration
No	-			

Method 1



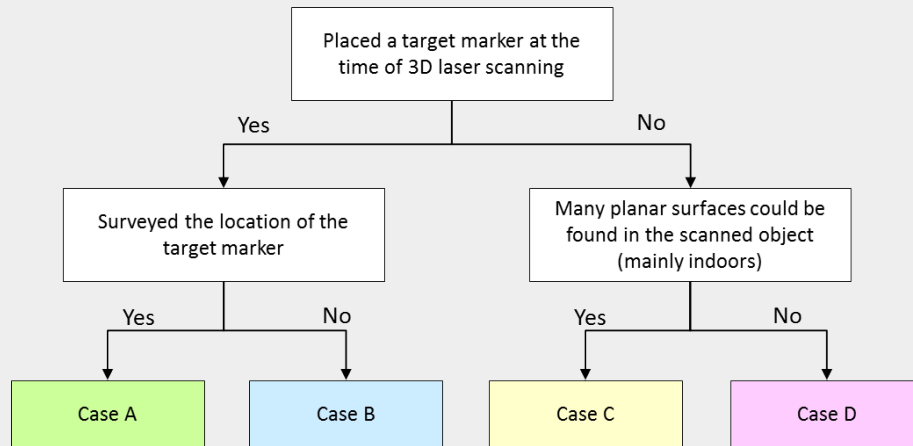
Method 2



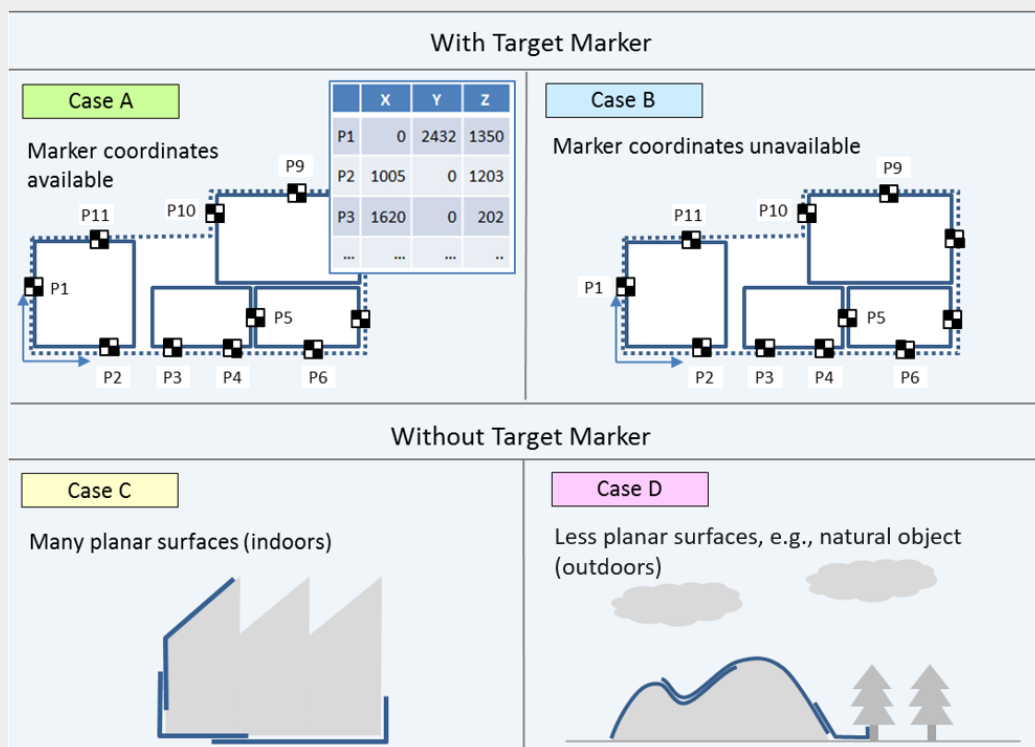
It is recommended to use markers (reference spheres / checker board) when laser-scanning landform to improve the registration accuracy. (Registration using extracted planes is often not available for this kind of scanned data because they do not contain sufficient planar shapes.)

Registration Using InfiPoints

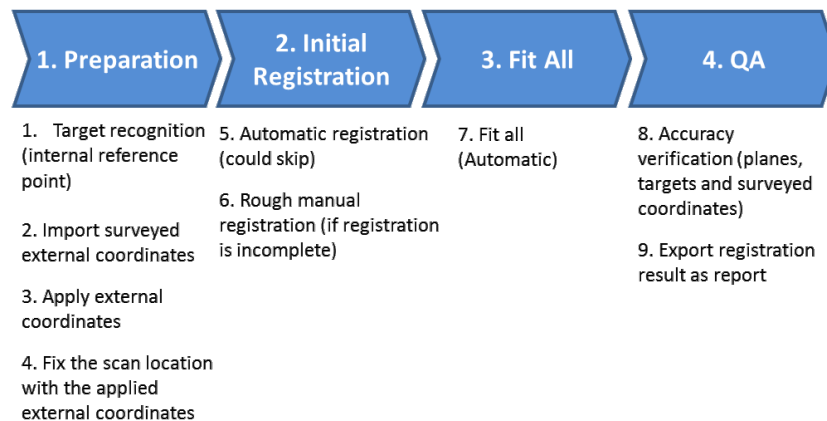
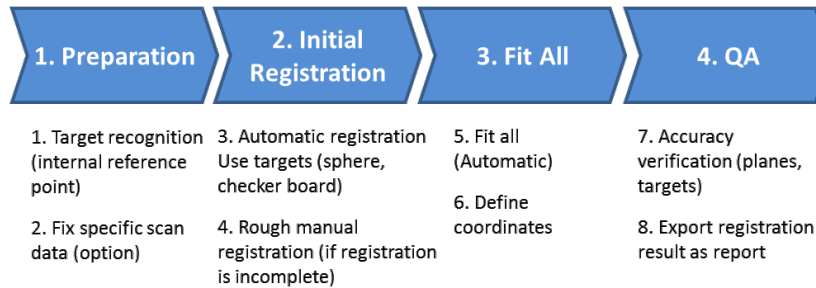
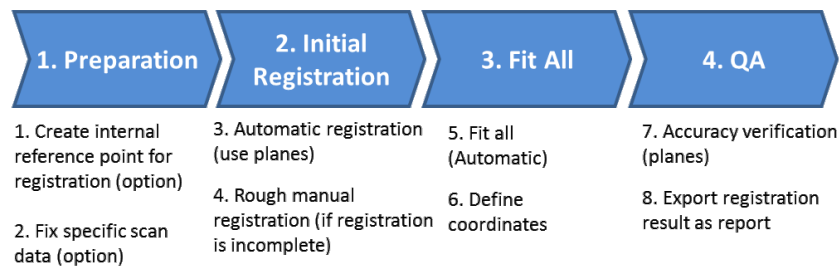
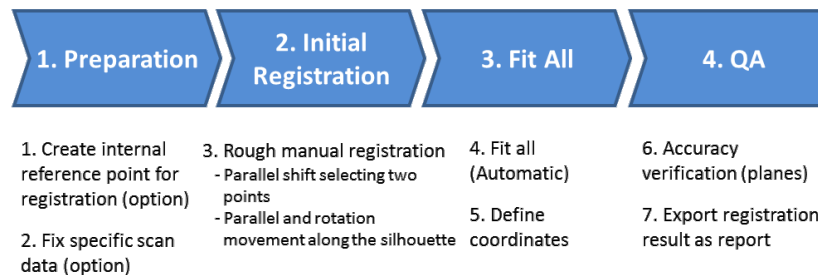
- Selecting the Optimal Registration Workflow



- Workflow Cases

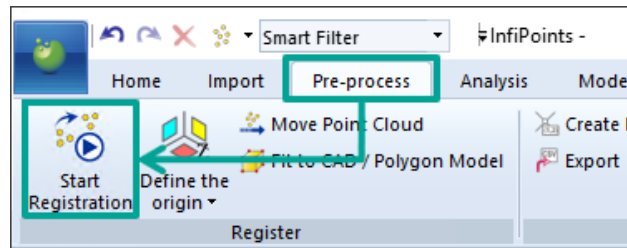


- Operation Flow in Each Case

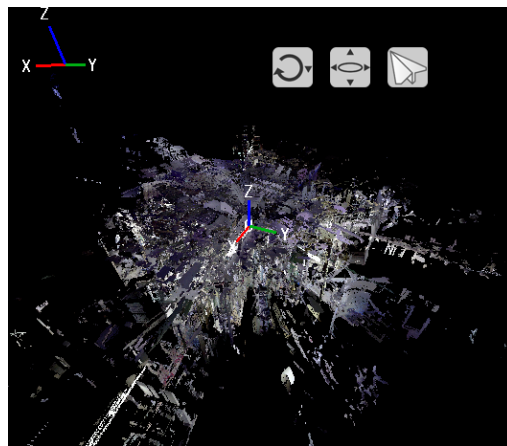
Operation Flow in Case A**Operation Flow in Case B****Operation Flow in Case C****Operation Flow in Case D**

4.2. Start Registration

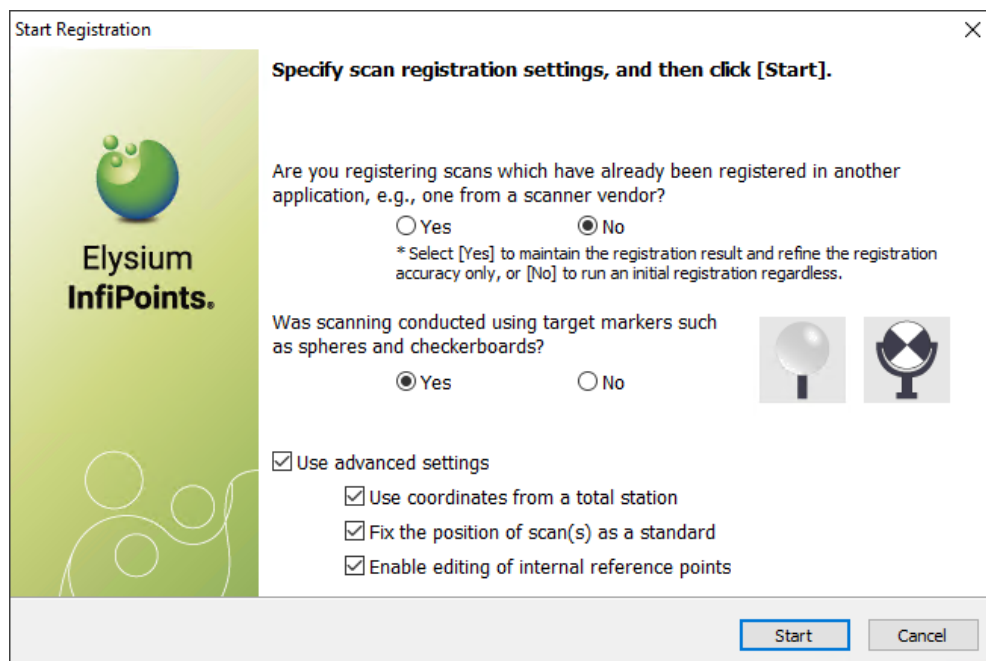
1. Press [Pre-process] tab > [Register] > [Start Registration] () from the ribbon menu.



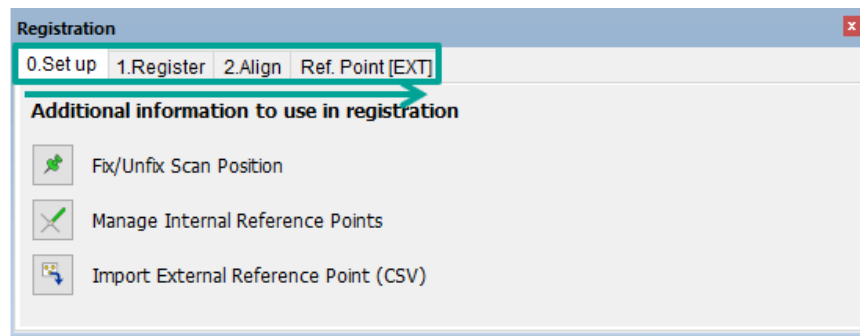
Scanned data are displayed overlapping each other on the "3D View" window initially.



2. "Start Registration" dialog will appear. Select the options and click [Start].



After selecting [Start], the [Registration] panel and the [Target] panel will appear.



Valid	Name	Type	Shot name	Distance from scan	Angle to
<input checked="" type="checkbox"/>	1 20150217A-1 - 1	Checker Board	20150217A-1	6.538	25.442
<input checked="" type="checkbox"/>	2 20150217A-1 - 2	Checker Board	20150217A-1	5.341	44.76
<input checked="" type="checkbox"/>	1 20150217A-4 - 1	Checker Board	20150217A-4	1.537	31.717
<input checked="" type="checkbox"/>	1 20150217A-5 - 1	Checker Board	20150217A-5	1.626	29.103
<input checked="" type="checkbox"/>	2 20150217A-5 - 2	Checker Board	20150217A-5	1.628	65.157
<input checked="" type="checkbox"/>	3 20150217A-5 - 3	Checker Board	20150217A-5	1.632	69.597
<input checked="" type="checkbox"/>	2 20150217A-6 - 2	Checker Board	20150217A-6	3.641	45.035

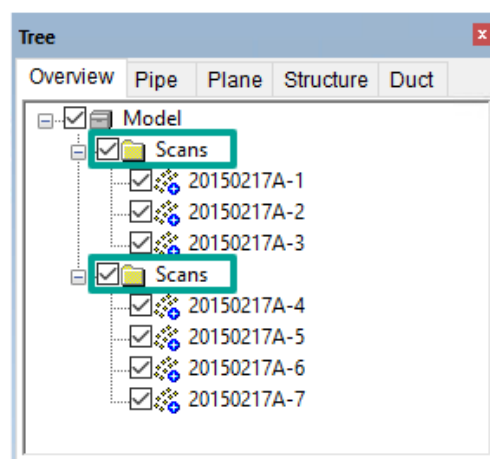


- Work your way from the left tab to the right.
- Depending on the option specified at "Start Registration" dialog, the tabs appear on [Registration] panel vary.



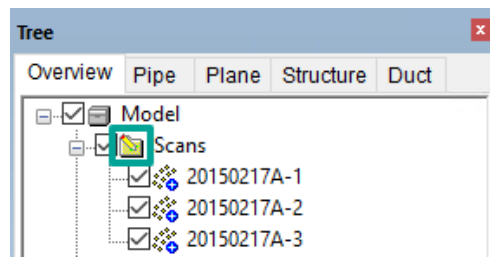
Coordinate information from surveying is called "external reference points."

3. Select one of the point cloud groups () to register if there are multiple ones in [Tree (Overview)] panel. Only the selected point cloud group will be the subject of registration.



This can be skipped when there is only one point cloud group in [Tree (Overview)] panel.

Pencil mark () is placed on the icon of point cloud group to register.



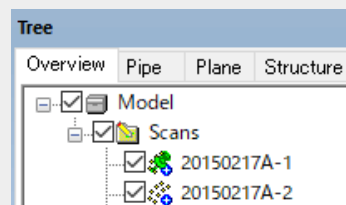
Preparing for Registration (Optional)

User can prepare for registration in [Registration (0.Setup)] panel.

- [Fix/Unfix Scan Position] ()

This is a function to fix the position of a certain shot / point cloud group to use it as a reference in registration / alignment.

Select a shot / point cloud group to fix from [Tree (Overview)] panel. Fixed shot / point cloud group will be pinned (green) in [Tree (Overview)] panel.



- [Manage Internal Reference Points] ()

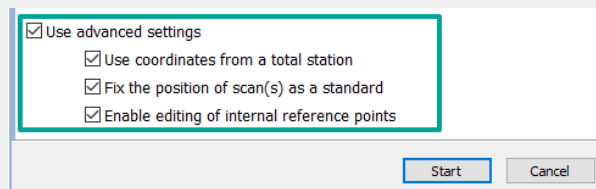
Targets (Internal Reference Points) can be edited in [Target] panel. Refer to "Extracting Targets (Internal Reference Points)" if there are targets or internal reference points.

- [Import External Reference Point (CSV)] ()

Survey coordinates and public coordinates can be imported. Please refer to "Import the External Reference Points" for details.



Depending on the options specified at "Use advanced settings" of [Start Registration] panel, icons displayed in [Registration (0.Setup)] panel vary.



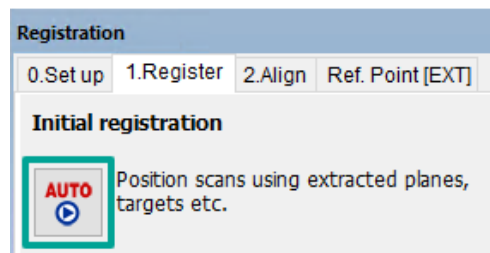
4.3. Registration (Auto)

Automatically register the point cloud data scanned from multiple locations with a 3D scanner using planes, target markers, and section images.

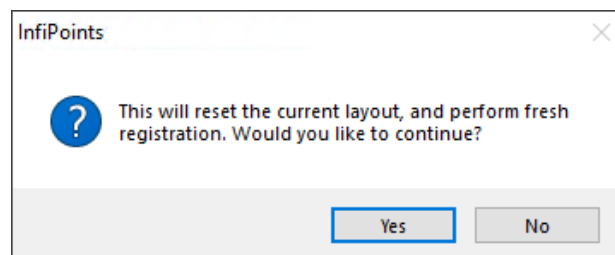


Please note that when there aren't any target markers when scanning with a 3D scanner or there aren't much planar geometric features on the point cloud data, such as natural objects outdoor, perform registration by [Registration \(Other\)](#).

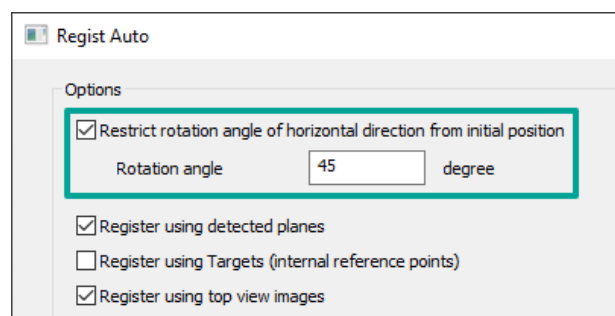
1. In [Registration (1. Register)] panel, press [Regist Auto] ().



2. The following dialog will appear. Click [Yes].

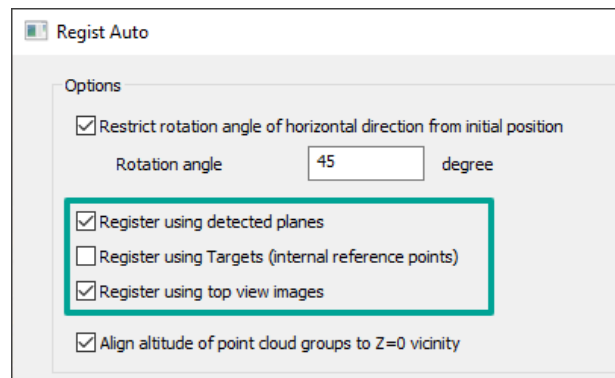


3. "Register Auto" dialog will be displayed. When the scanned data contains compass information, enable "Restrict rotation angle of horizontal direction from initial position".



Restricting the angle of rotation in the horizontal plane reduces the possibility of incorrect calculation results.

4. Enable "Register using detected planes", "Register using Targets (internal reference points)", or "Register using top view images" to use for [Regist Auto].



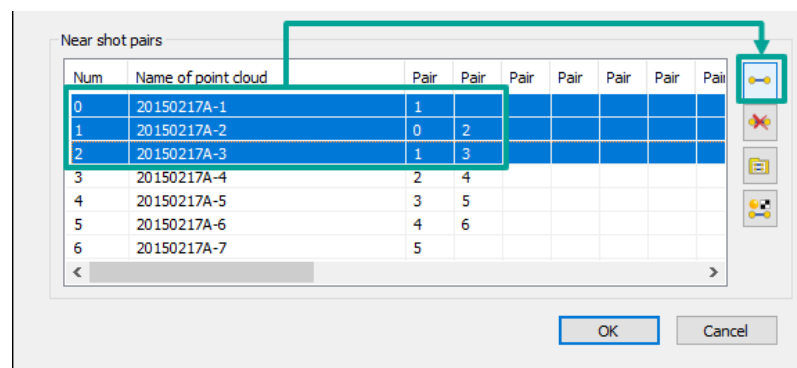
Multiple selection is available. At least one of the three has to be selected.

5. Specify target pairs when necessary.


◦ Specifying pairs manually

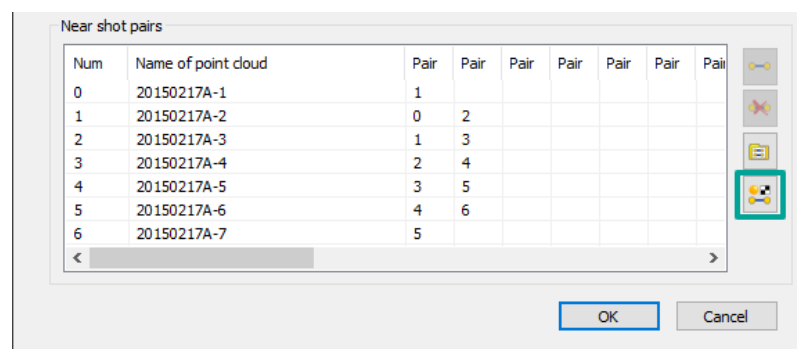
- Select [Add adjacent point cloud] () with at least two point cloud shots selected.

e.g., Selected point clouds will be set as pairs (No. 0-2 in the case above).



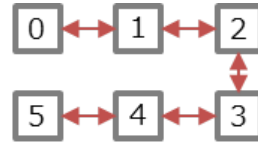
◦ Estimating pairs from the target

- Press [Add Pair Shots by Internal Reference Points] ().
- If there are no point cloud pairing information, this menu is used.

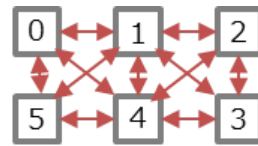


As more pairs are set for each point cloud data, the success rate of automatic registration can become higher, but the processing time could increase.

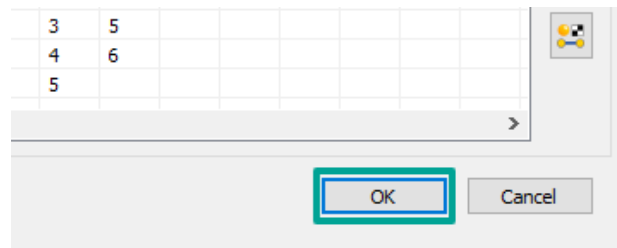
(Ex.1) Selecting one neighboring point cloud as pairs for each scan



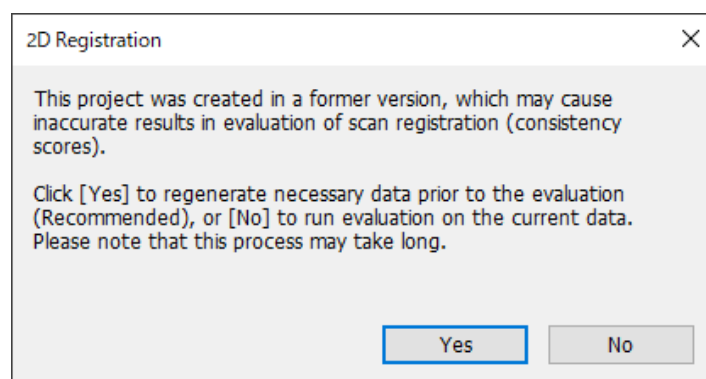
(Ex.2) Selecting multiple neighboring point cloud as pairs for each scan



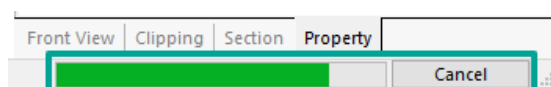
6. In [Regist Auto] panel, click [OK] to start auto registration.



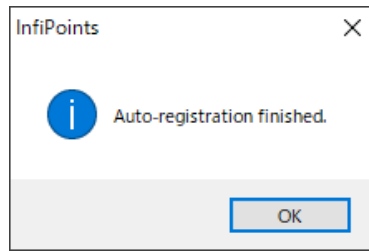
Please note that if the project data is out of date, the following dialog may appear. Click [Yes] as is to update the required data.



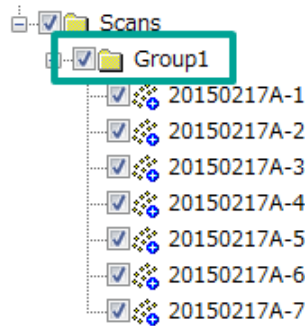
Each process could be monitored at the bottom right corner status bar.



7. Click [OK] in the dialog, and registered scans, which means "the correspondence is detected," will be grouped together

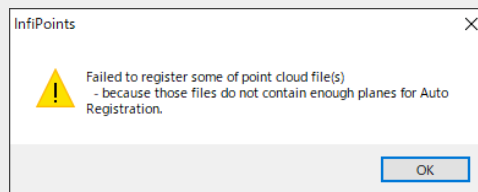


When auto-registration is successful for all point cloud parts, they will be classified into one point cloud group. In that case, select [4.5, “Aligning All Point Cloud Data”](#) to align all.

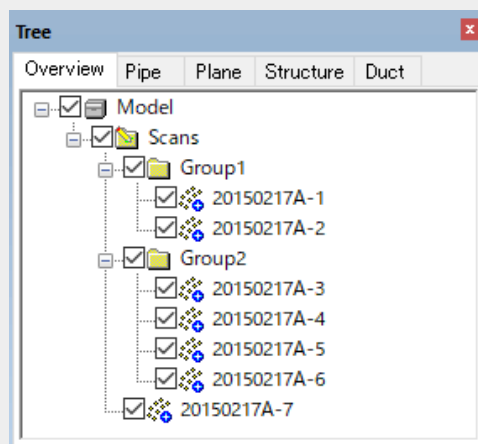


If not classified into one point cloud group

If there are two or more point cloud groups after automatic registration, proceed to [4.4, “Registration \(Other\)”](#).



e.g., Shot #1 and #2 in Group 1, shot #3 to #6 in Group 2, but no correspondence was detected with shot #7

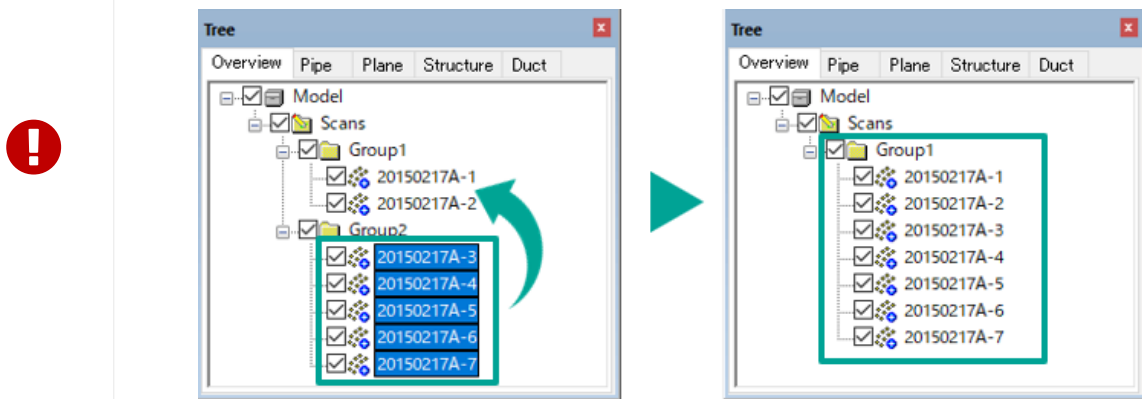


4.4. Registration (Other)


When auto registration does not align the point cloud data, you can perform registration in the following ways:

- 4.4.1, “Auto Registration Using the Top View Images”
- 4.4.2, “Register by moving shots manually in [Top view/Front view] panel”
- 4.4.3, “Register by moving shots manually”
- 4.4.4, “Register by using targets (Internal reference points)”
- 4.4.5, “Define vertical direction of point cloud”

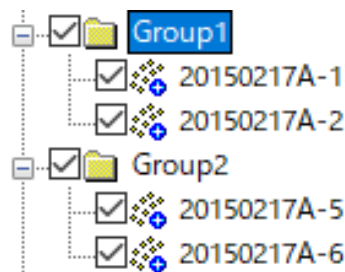
After manual registration is completed, move the point cloud parts from separate point cloud groups into one on the structure tree.





4.4.1. Auto Registration Using the Top View Images

Automatic registration can be executed by using the Top View Image. This might be effective for registration of point cloud data which cannot be registered automatically by [Regist Auto] () (e.g., point cloud without scan index, point cloud taken outdoor with few artifacts).

1. Select the sub-group to move from [Tree (Overview)] panel.

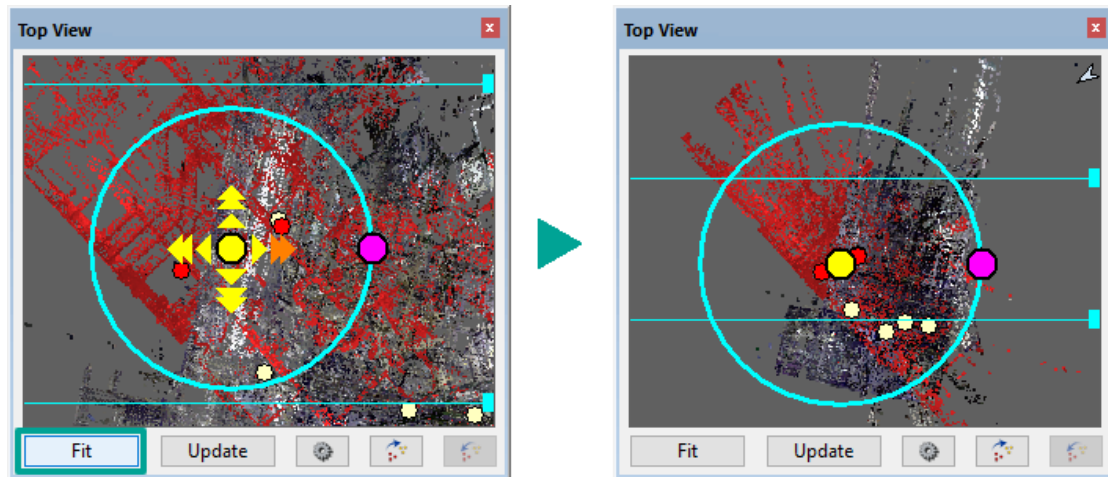




If [Auto-register Based on Top view] () in [Top View] panel is not displayed, press [Pre-process] tab > [Register] > [Start Registration] () to start registration.

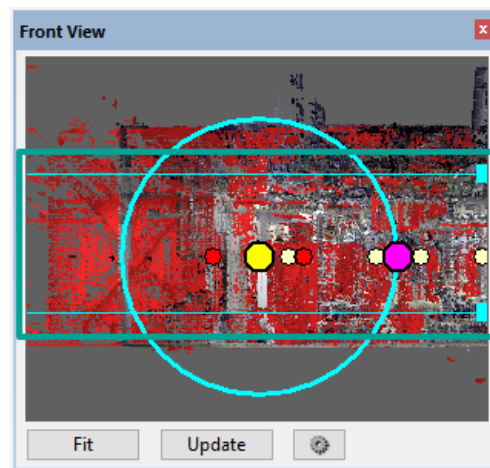


2. Adjust the display range in Top panel so that whole point clouds are displayed.

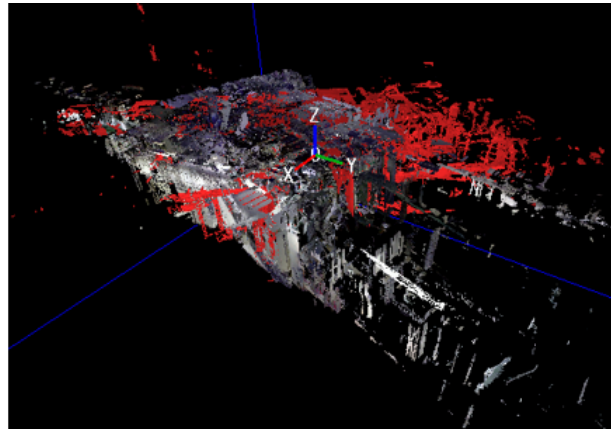
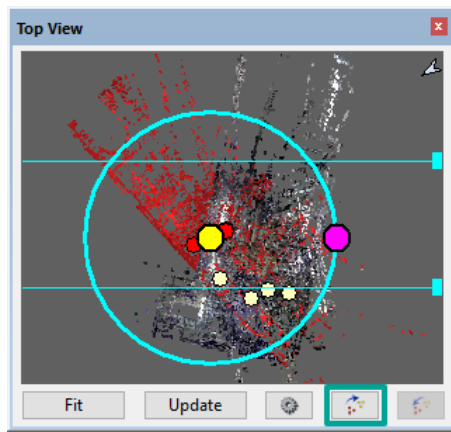


Display range can be adjusted by either of [Fit], dragging the mouse with right clicking, or mouse wheel(zoom in/zoom out).

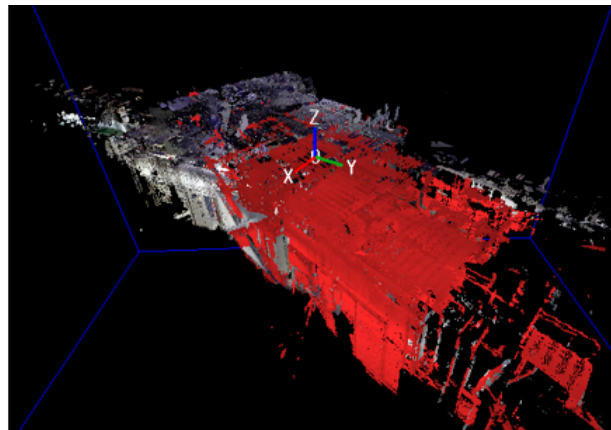
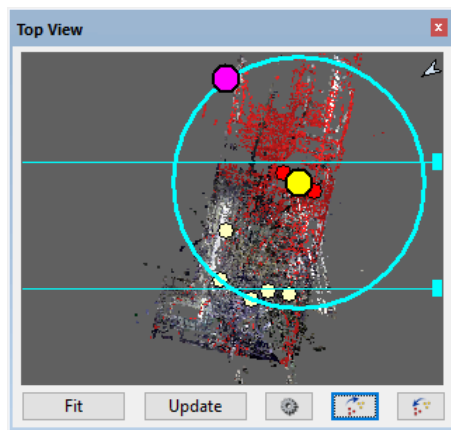
3. Adjust the top view section by moving the slider in [Front View] panel to ensure that the outline of point clouds is clearly visible.



4. Press [Auto-register Based on Top View] () in [Top View] panel.



The selected sub-group will move to proper position automatically.

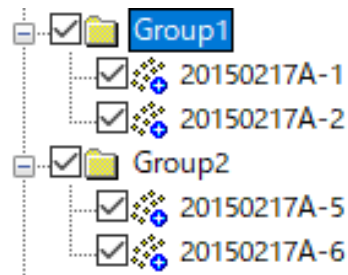


You can cancel the last move by selecting [Undo] () in Top panel.

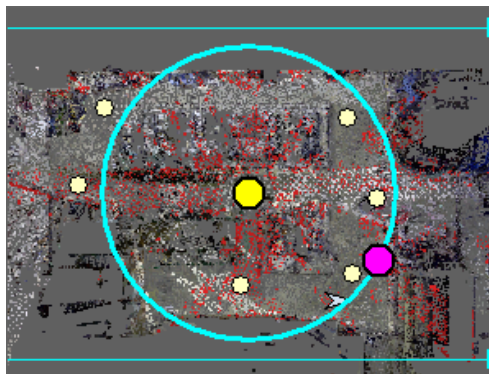
4.4.2. Register by moving shots manually in [Top view/Front view] panel

You can correct the relative position of shots / point cloud groups that are not registered by auto-registration by moving and rotating them in [Top View] / [Front View] panel. Following is the way to manually arrange sub-groups in proper positional manner.

1. Select a shot / sub-group to move in [Tree (Overview)] panel.



Handles for movement will appear on [Top View]/[Front View] panel.

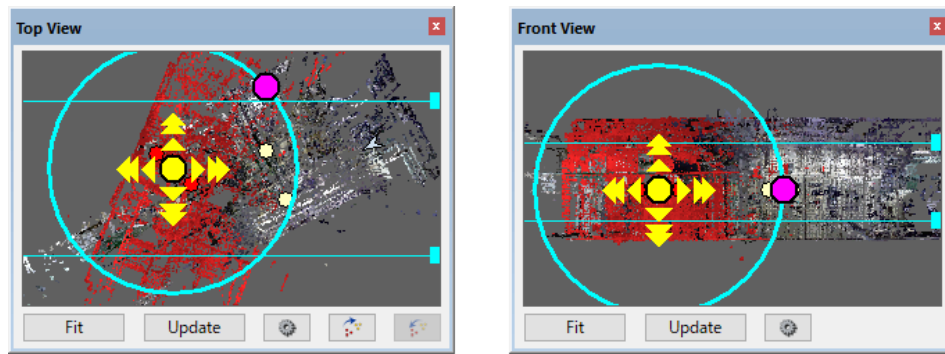


When moving handle does not appear for neither top nor front panel, please check the followings:



- Has registration started already?
- Were point cloud part or group that are a part of the registration group selected?

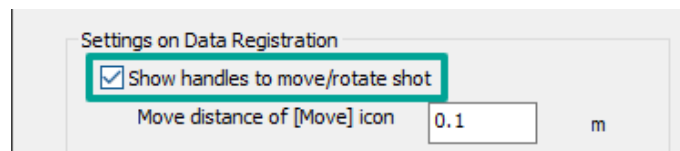
2. Move or rotate the selected shot or the selected point cloud group in [Top View] / [Front View] panel by dragging the following:

- Yellow handle  : To move parallel
- Pink handle  : To rotate



Bring the mouse cursor over the handle to show buttons to move / rotate by specified distance only.

-  : Press this to move by the distance / rotation for the angle specified at [Settings] only
-  : Press this to move / rotate at three times the value specified at [Settings] (This is not available unless [Show handles to move/rotate shot] is enabled in [Settings on Data Registration].)



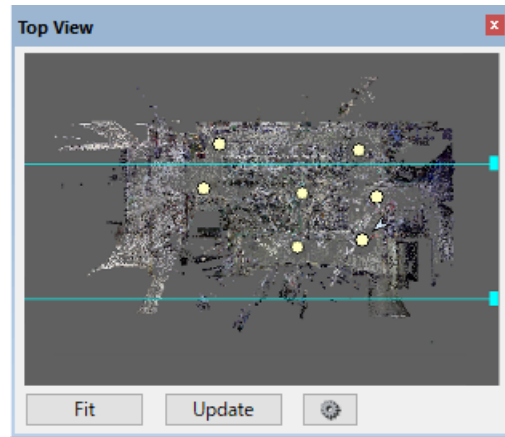
At this phase, please ensure that all shots are placed at roughly right positions (no need to register precisely for now) for the next phase (automatic alignment in [Registration (2.Align)] panel).



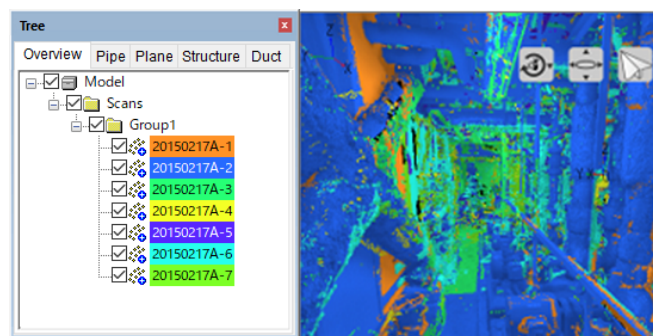
You can also use [Move] () to move shots / point cloud groups in 3D View Window.

Point Cloud Display Method

- [Top View] / [Front View] panel displays point cloud data in section view. To improve the work efficiency, adjust the section width for [Top View] panel by moving blue bars in [Front View] panel.



- [Classify Points by Color] () Color points per scan shot. This is effective to visually check the relative position of registered shots.

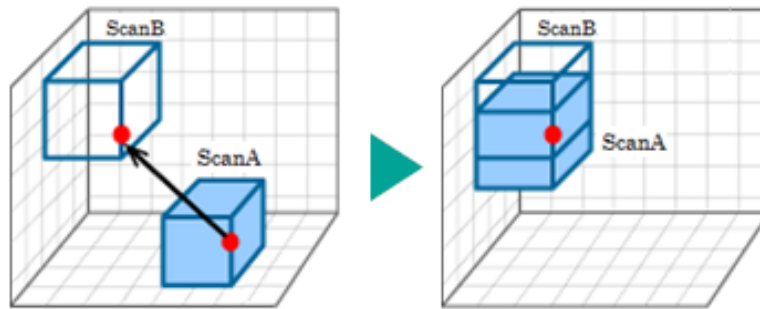


You can further improve the visibility by showing two or three relevant shots only, and switching to "Section Mode".

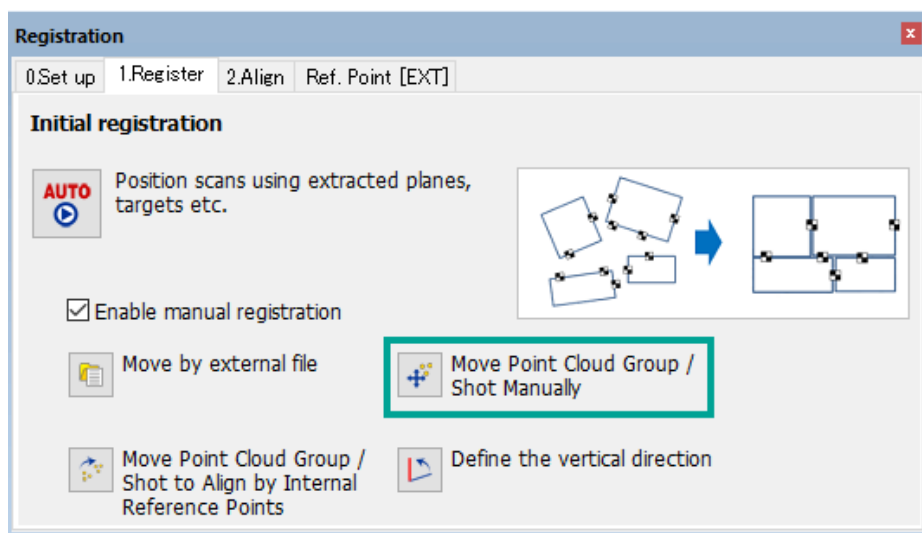


4.4.3. Register by moving shots manually

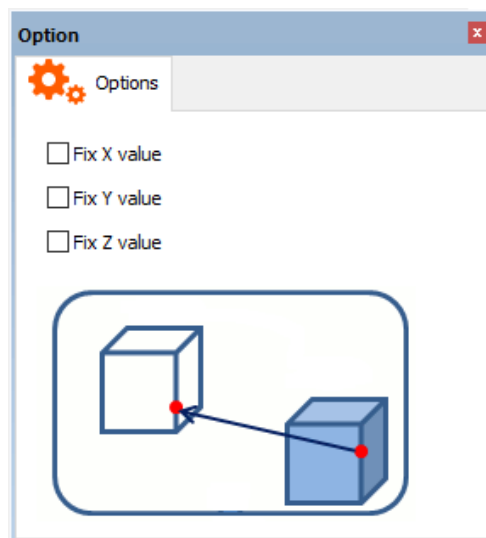
You can also correct the relative position of shots / point cloud groups that are not registered by auto-registration by moving them in 3D View Window.



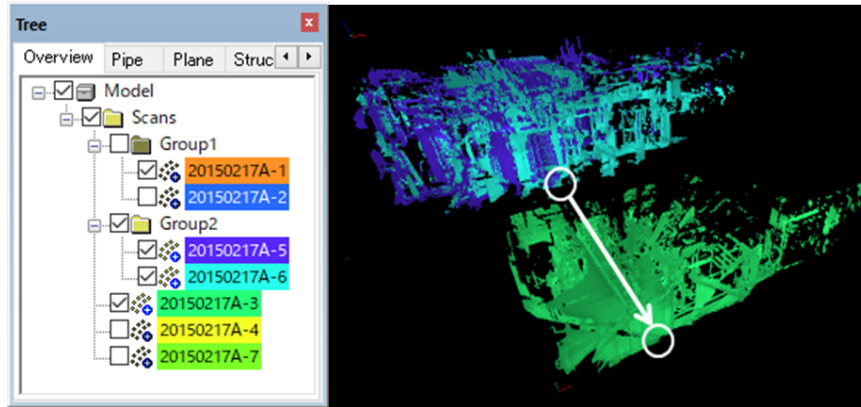
1. Open [1.Register] in [Registration] tab. Enable [Enable manual registration] and select [Move Point Cloud Group / Shot Manually] ().



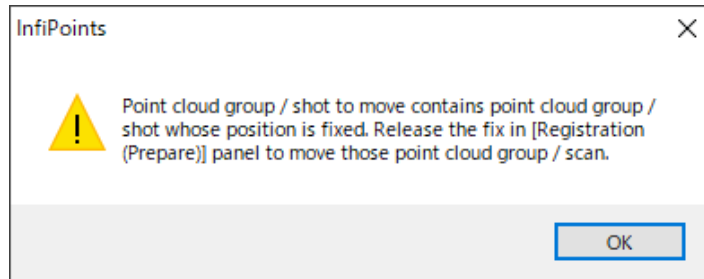
2. Check in the checkbox to restrict the movement by fixing the coordinate value if necessary. E.g., Enable "Fix X value" and "Fix Y value" in [Option] panel to move parallel along Z axis (change Z value only). Or shot / point cloud group will be moved to any direction.



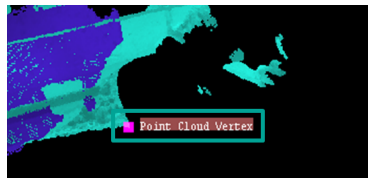
3. Select a shot / point cloud group to move in [Tree (Overview)] panel.



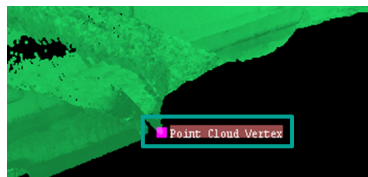
Please note that you cannot move fixed shots / point cloud groups. (You need to unfix them first.)



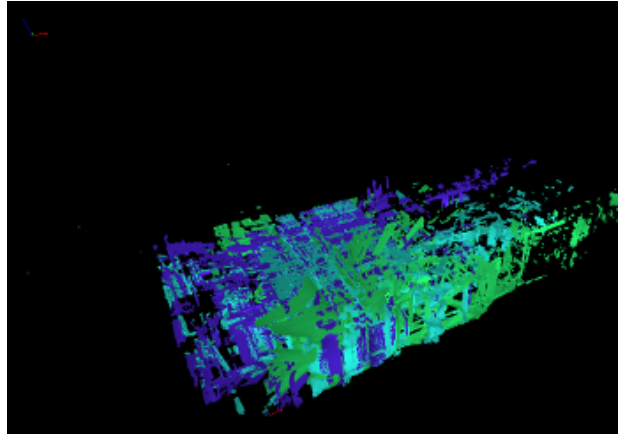
4. Specify a point #1 to move in 3D View Window.




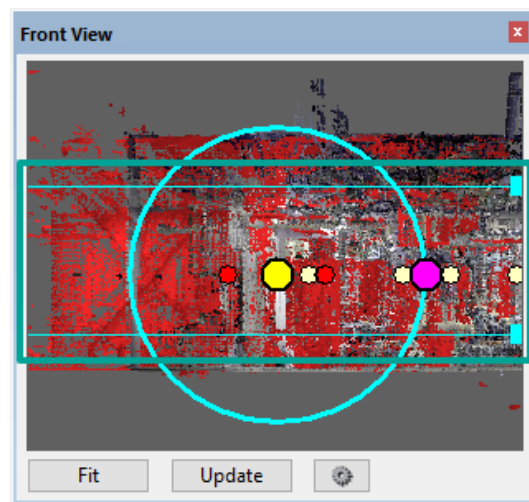
Specify a point #2 to move to in 3D View Window.



Selected shot / point cloud group will be moved to match #1 point to #2 point.



In case that the position of point clouds is not aligned properly, move the slider in Front panel to adjust the outline of point clouds and run [Register using top view images] () again.

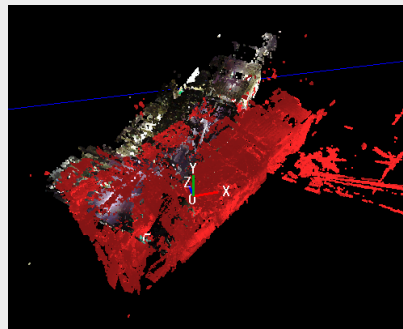
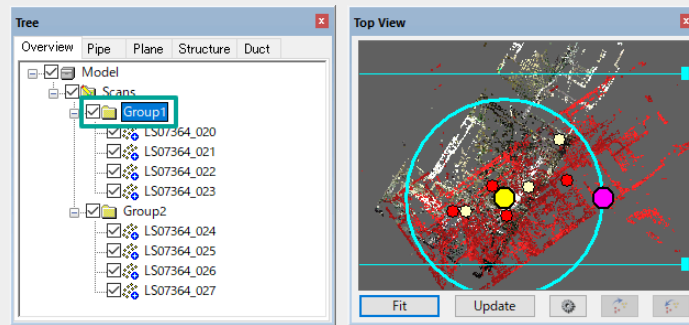


4.4.4. Register by using targets (Internal reference points)

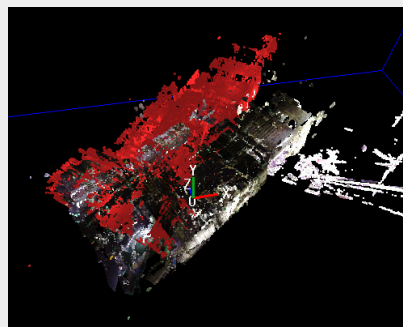
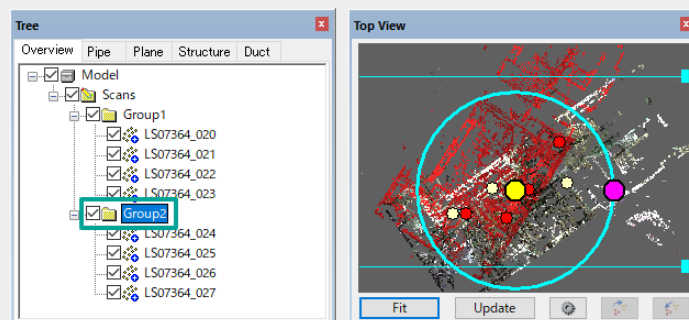
By setting a target (internal reference point) in a common place without moving the point cloud part in each group, the groups' position can be aligned by matching the targets.

Relation between Group 1 and Group 2

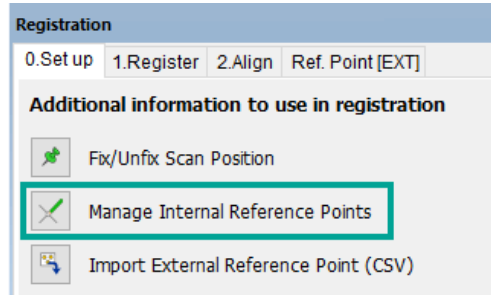
- Group 1




- Group 2

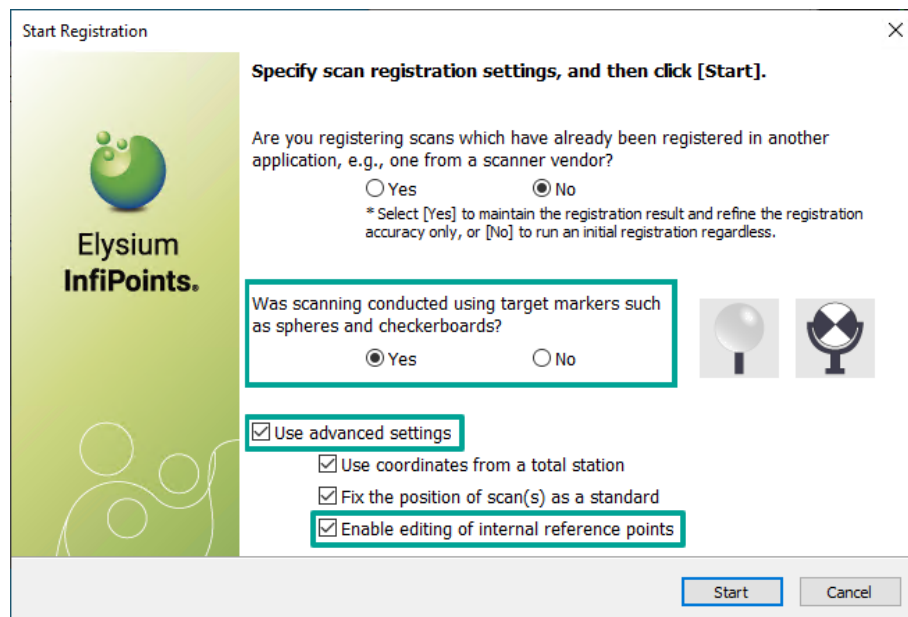


1. In [Registration (0.Set up)] panel, press [Manage Internal Reference Points] ().

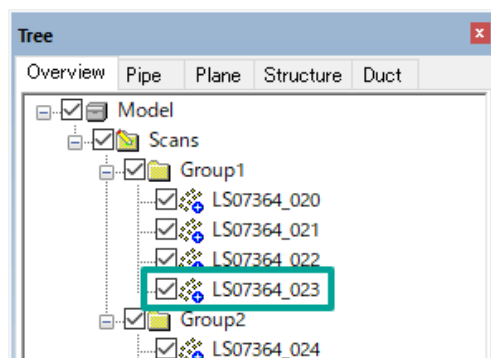


Please note that when [Manage Internal Reference Point] () does not appear in [Registration (Step 0)] panel, then set the following in "Start Registration" dialog.

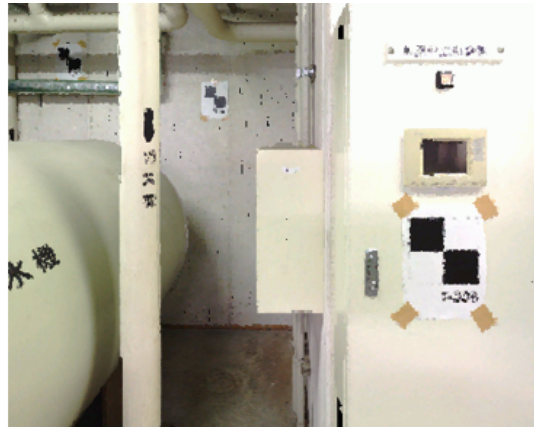
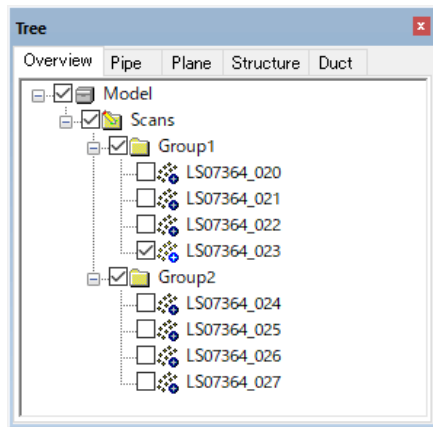
- Select "Yes" for "Was scanning conducted using target markers such as spheres and checkerboards?"
- Enable "Use advanced settings" and "Enable editing of internal reference points".



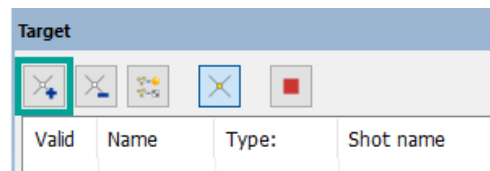
2. Specify the point cloud part to edit in [Tree (Overview)] panel.



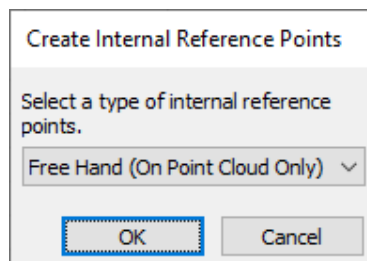
Viewpoint of "3D View" window will move to the scanned origin of the specified point cloud part. Also, only the specified point cloud part will be shown; others hidden.



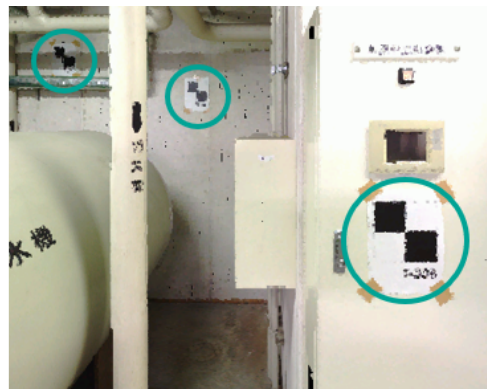
3. [Registration] panel will switch to [Target] panel. Press [Add] () in [Target] panel.



4. "Create Internal Reference Points" dialog will appear. Switch the type to "Free Hand (On Point Cloud Only)", then click [OK].



5. When selecting a point at the position where you want to create a target (internal reference point) in "3D View" window, the target (internal reference point) will be created.





"Checker Board" is also selectable as a target type to create a target (internal reference point). Please refer to "[Create targets manually \(Checker Board\)](#)" for more details about how to create targets with "Checker Board".

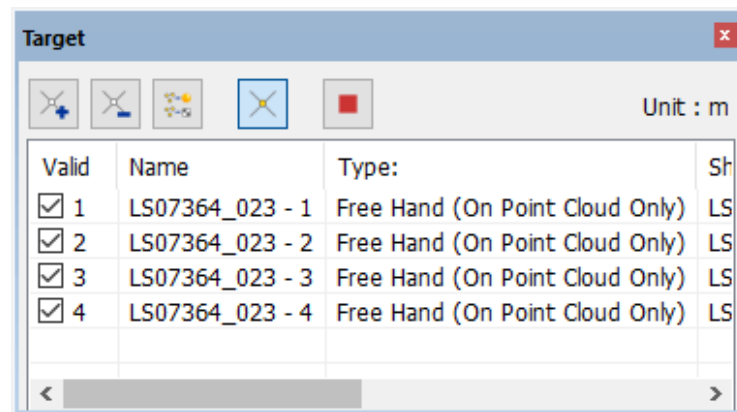



Please note the following when creating internal reference points to avoid inverting the left and right during registration.

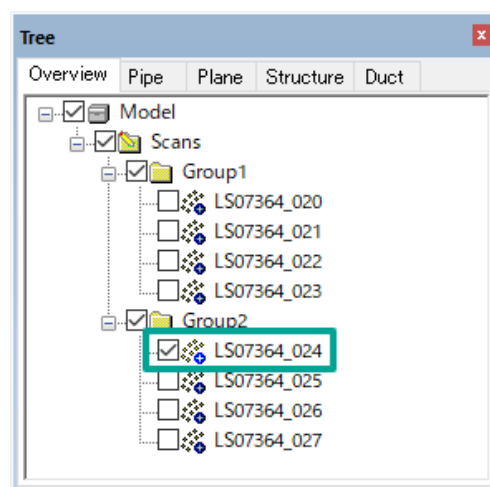


- Select points, but try not to line them up in a straight line.
- Try to select one or more points that are not on the same plane.
- Please note that when the target (internal reference point) does not appear on "3D View" window, press [Hide Internal Reference Points] () of [Target] panel and switch to [Show Internal Reference Points in "3D View" Window] ().
- Target (internal reference point) will not appear on the structure tree.

Information about the target (internal reference point) can be confirmed on [Target] panel.

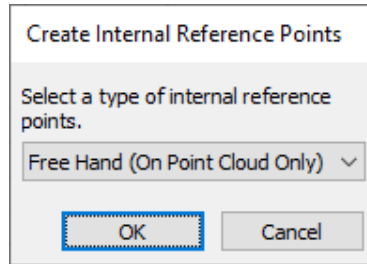


6. Press [Cancel the selection and quit this function] () to finish creating the target (internal reference point).
7. Next, among the point cloud parts belonging to Group 2, specify the point cloud part in the structure tree which includes the scanned object used as the target (internal reference point) created earlier.

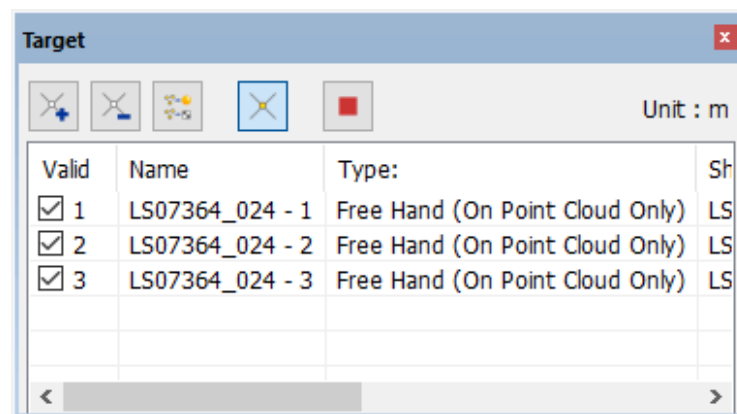





8. Again, press [Add] () in [Target] panel.
9. "Create Internal Reference Points" dialog will appear. Switch the type to "Free Hand (On

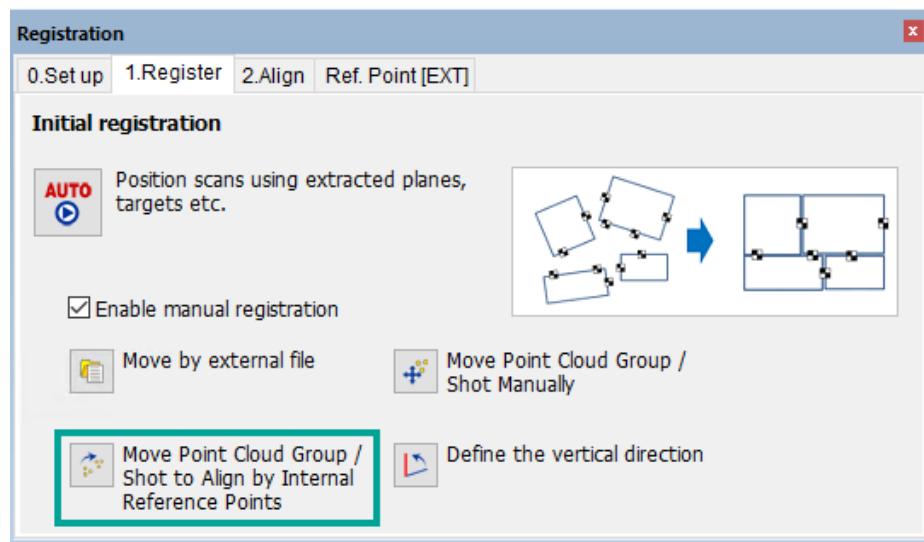
Point Cloud Only)", then click [OK].



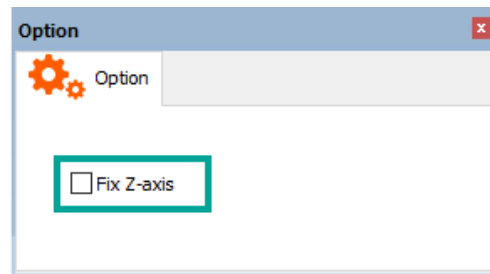
10. On "3D View" window, pick the same location as the target (internal reference point) you just created, and create a target (internal reference point).



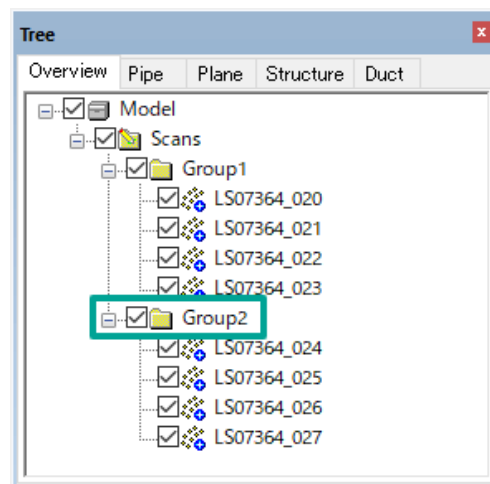
11. Press [Cancel the selection and quit this function] () to finish creating the target (internal reference point).
12. Select [Finish Editing Internal Reference Points] () on [Target] panel, and finish editing the target (internal reference point).
13. In [Registration (1.Register)] panel, press [Move Point Cloud Group / Shot to Align by Internal Reference Points] ().



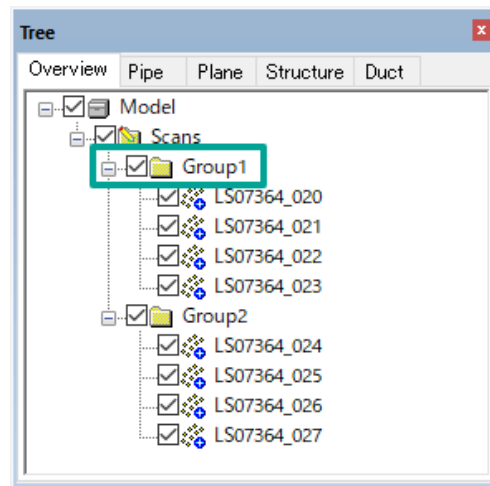
14. In this case, disable "Fix z-axis" in [Option] panel.



15. Select "Group 2" from the structure tree to specify which point cloud group to move.

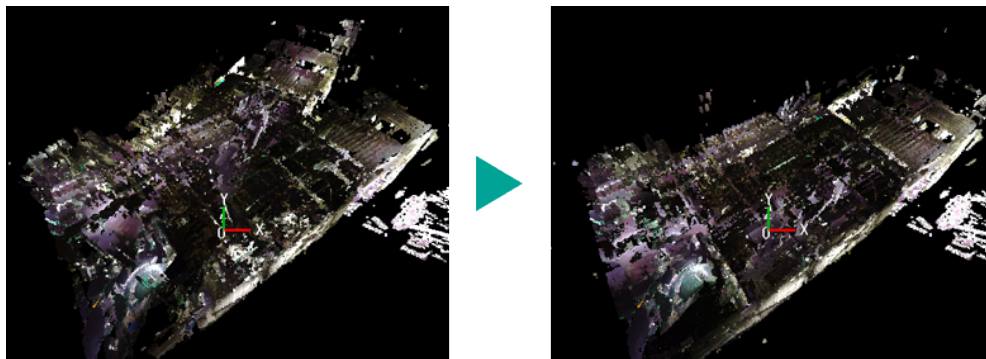


Select "Group 1" in the structure tree to specify the target point cloud group.

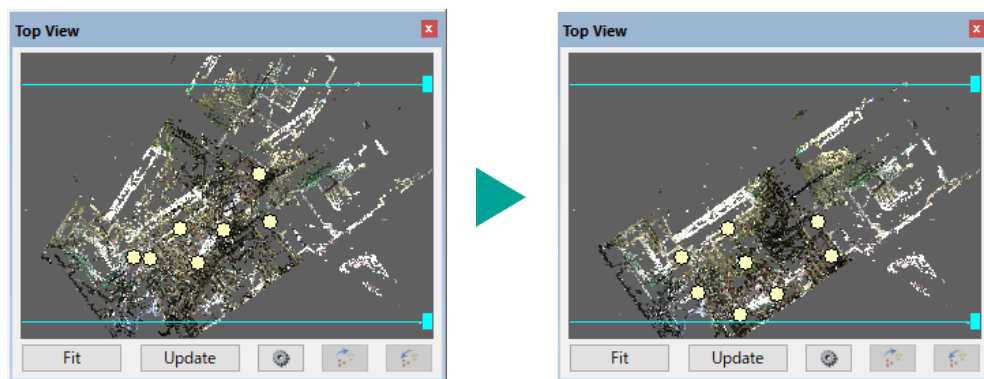


"Group 2" will move to match "Group 1".

■ 3D View window




■ Top panel

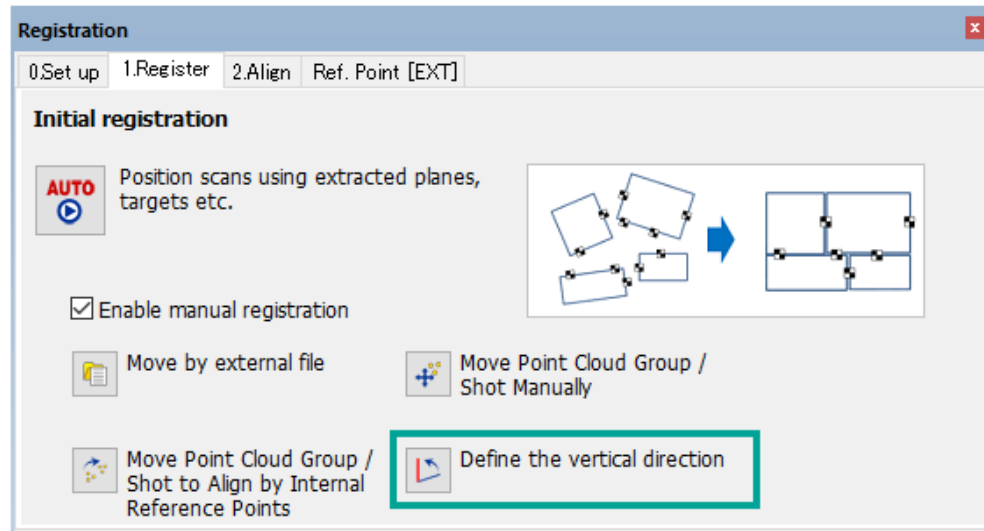


4.4.5. Define vertical direction of point cloud

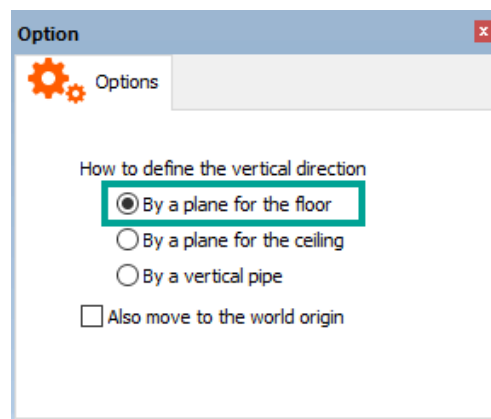
You can specify the vertical direction for scan shot (or point cloud group) whose vertical direction is not available. This function is effective for registering point cloud data from handy scanners or point cloud data without scan index data.

■ Define the vertical direction by a plane for the floor

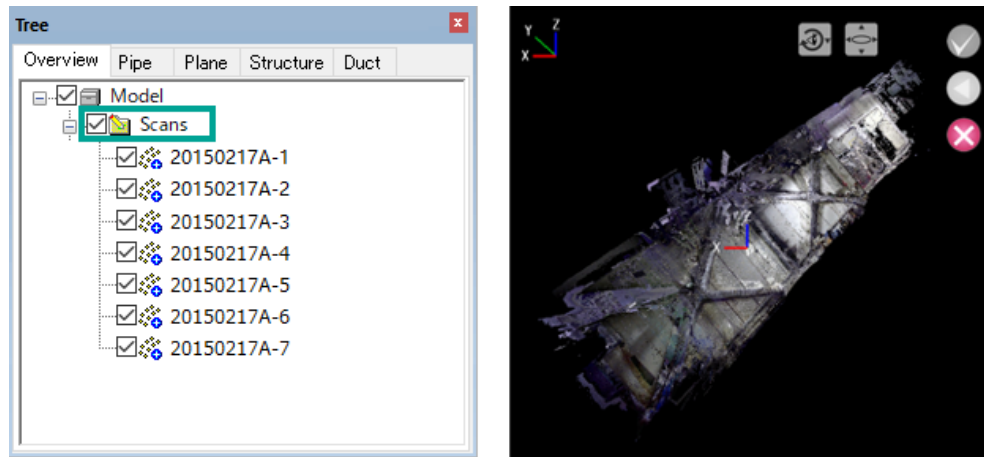
1. Select [Registration (1.Register)] panel, check "Enable manual registration" option, and click [Define the vertical direction] ().



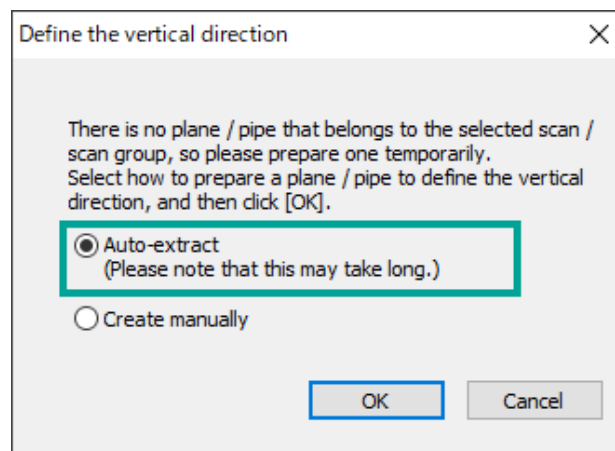
2. Specify a method in [Option] panel. Select "By a plane for the floor" option as an example here.



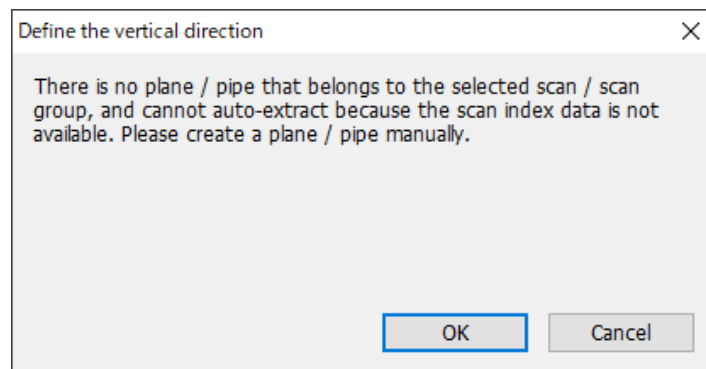
3. Select the target scan / scan group in either [Tree (Overview)] panel or the 3D View window.



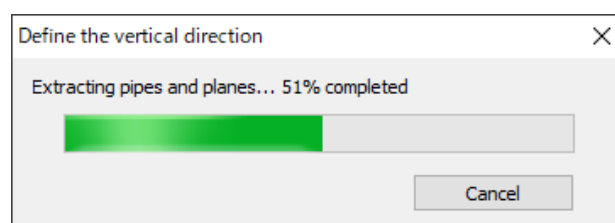
4. "Define the vertical direction" dialog will appear when the selected scan / scan group does not include any planes just under. Here, select "Auto-extract" and click [OK].



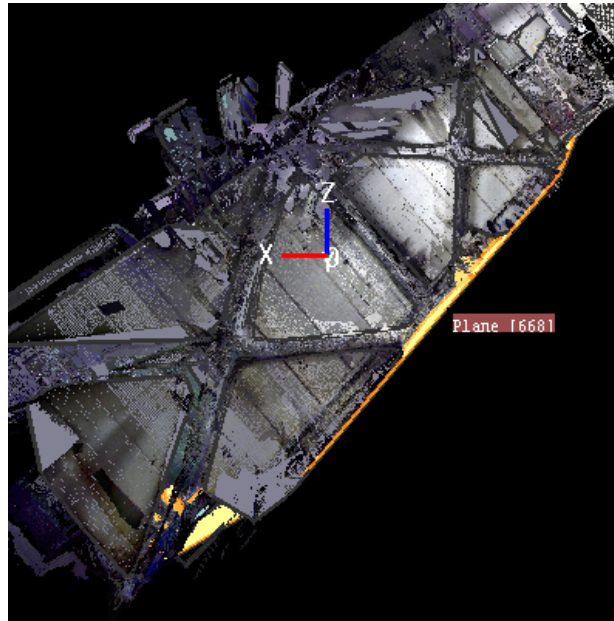
Please note that the function to auto-extract planes and pipes does not work on point cloud data without scan index data.



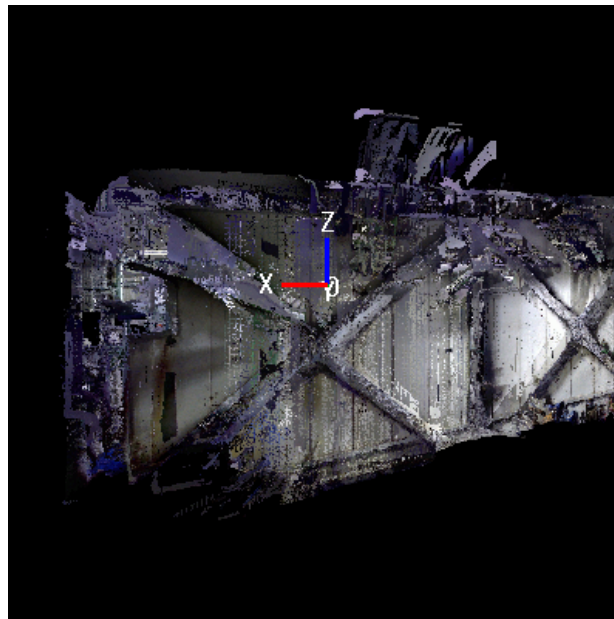
The plane will be auto-extracted.




5. Select the plane to define as the floor from the extracted plane on the 3D View Window.

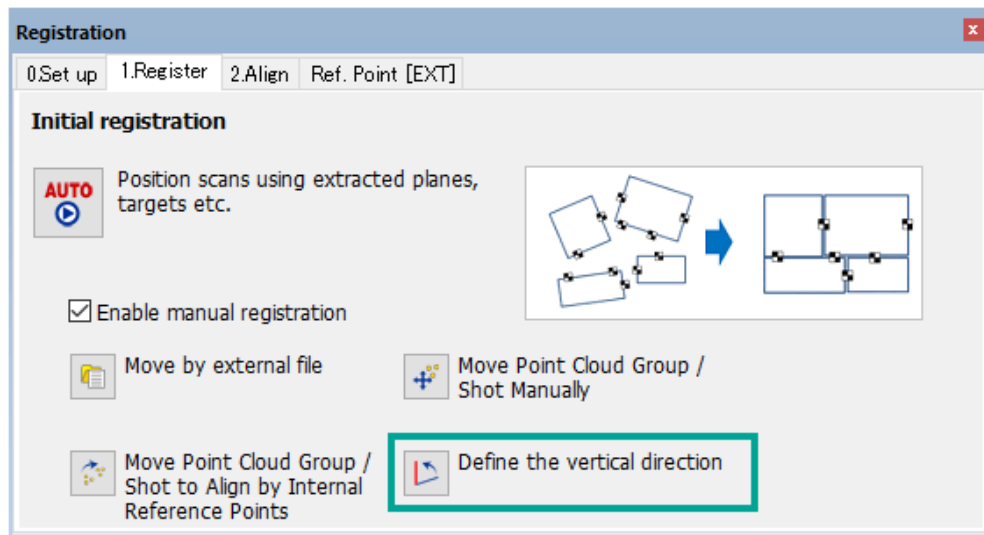


The point cloud will move so the Z-axis will become perpendicular to the chosen plane.

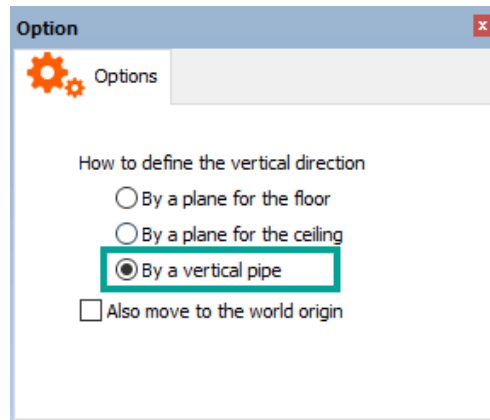


■ Define the vertical direction by a pipe

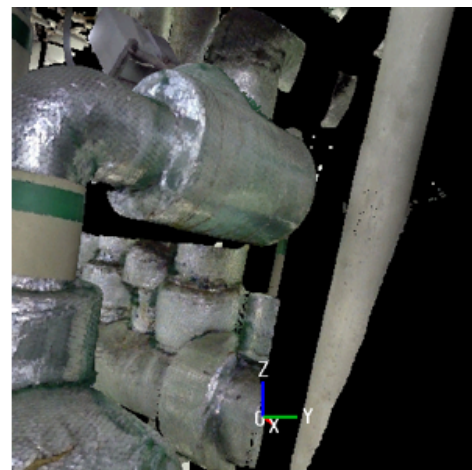
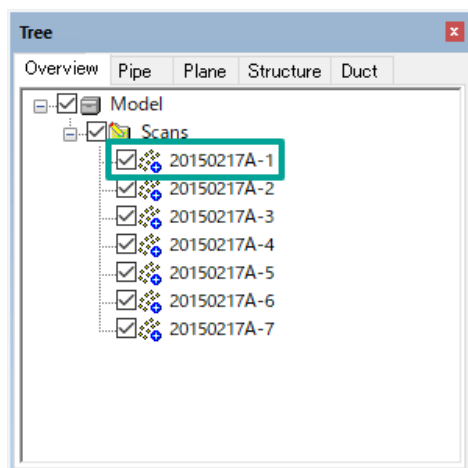
1. Select [1. Register] from the Pre-process tab. Check On [Enable manual registration] and select [Define the vertical direction] ().



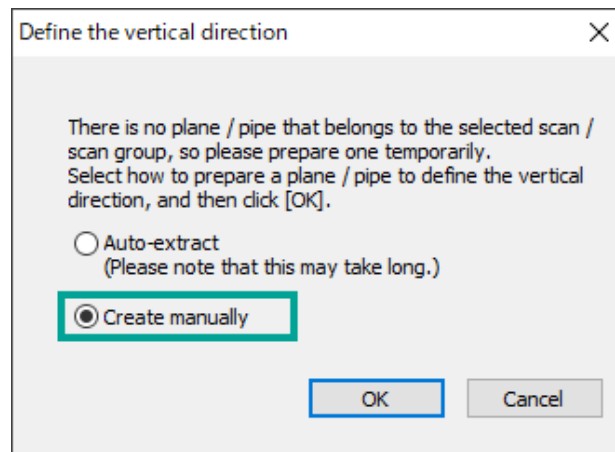
- Specify the method from the Option panel. In this case, select "By a vertical pipe".



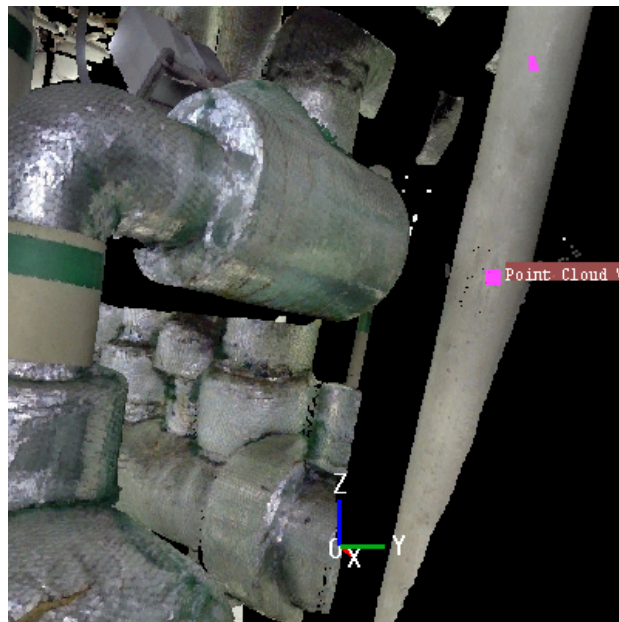
- Select one of shots/point cloud groups to specify the vertical direction from either [Tree (Overview)]tab or the 3D View Window.



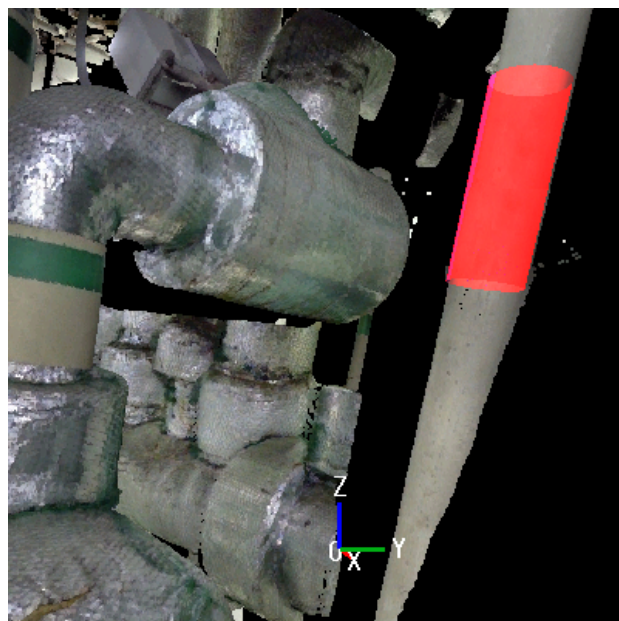
- If the selected shots/point cloud groups do not have any pipes just under, "Define the vertical direction" dialog will appear. Here, select "Create manually" and click [OK].



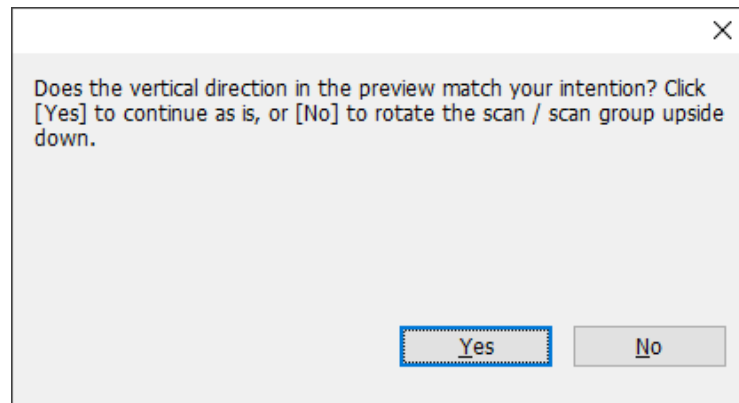
5. On the 3D View Window, pick two points where you would like to create a pipe.



6. Select the created pipe. A dialog will appear, asking if you would like to rotate the scan/scan group upside down?



7. If the vertical direction is correctly displayed in the preview of "3D View" window, then click [Yes]. To turn it upside down, click [No].



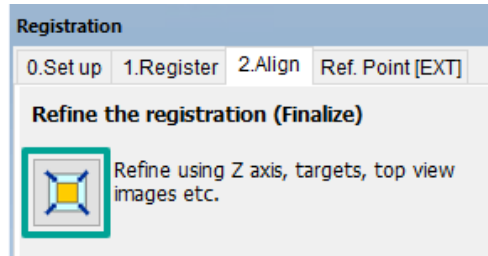
The point cloud will move so the Z-axis will become the axis of the chosen pipe.



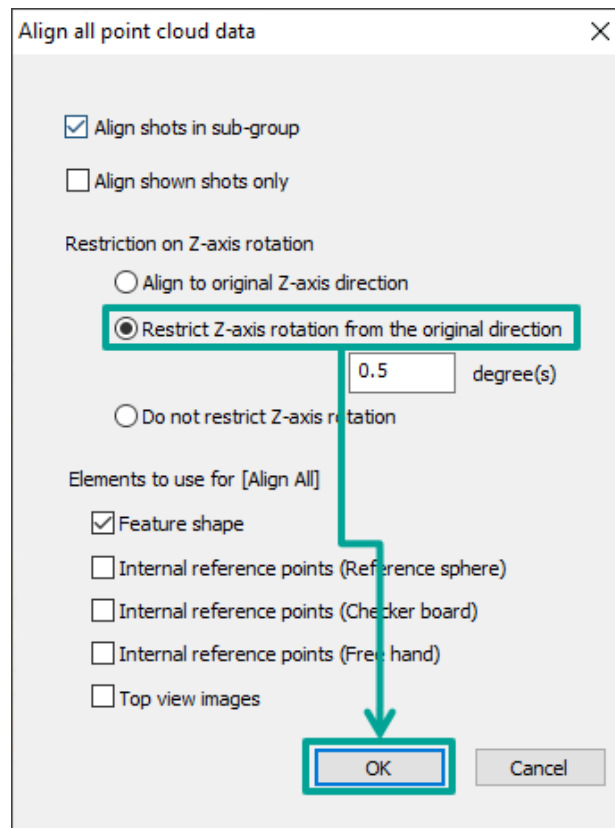
4.5. Aligning All Point Cloud Data

Following is the way to adjust scan shots to minimize the error of whole point clouds based on the result of Registration.

1. Move to the [2. Align] tab in the [Registration] panel and select the [Align All] .



2. Specify "Restrict Z-axis rotation from the original direction" in the "Align all point cloud data" dialog and click [OK].



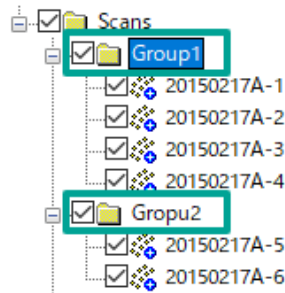
- There are cases where small errors are found in the z-axis direction, but accepting this error allows a more accurate registration as a whole.



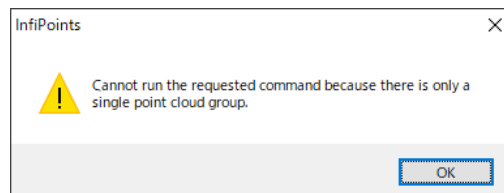
Amount of error between point clouds could be examined in the [Check] tab of the [Registration] panel.

Align shots in sub-group option

- Check this option to align per scan shots, or check off to align per sub-group (fix the positioning within each sub-group).



- Please ensure that there are at least two sub-groups when this option is checked off.



You can also align using [Fix/Unfix Scan Position] in combination.

- Per shot ("Align shots in sub-group" option checked) while fixing the position of certain shots
- Per sub-group while fixing the position of certain point cloud groups

Restriction on Z-axis rotation option



- This is to improve the registration accuracy by specifying the restriction on Z-axis rotation. This is effective because the accuracy of the inclination sensor differs depending on the scanner specification. Specify the maximum allowed angle for Z-axis rotation to allow to align scan shots / point cloud groups while rotating them along Z-axis (vertical direction) within a tolerance. Select an optimum option (and tolerance value when selecting second option) based on the specification of the inclination sensor of the scanner used in scanning.

Elements to use for [Align All] option

- Please select target types (reference sphere / checker board / free hand) created in [Registration (Check)] panel.



Registration			
0.Set up	1.Register	2.Align	Ref. Point [EXT]
Check			
By target			
Paired Targets	Type:	Mean value[mm]	Max. value[mm]
Paired Targets1	Checker Board	27.606	27.606
Paired Targets2	Checker Board	2.972	4.272
Paired Targets3	Checker Board	22.717	36.203

- [Align All] can be executed while fixing the position of multiple scan shots by [Fix Scan] ().

4.6. Check Registration Result

Check the accuracy of registration. Based on targets or extracted planes, the gap between multiple point cloud parts can be checked numerically.

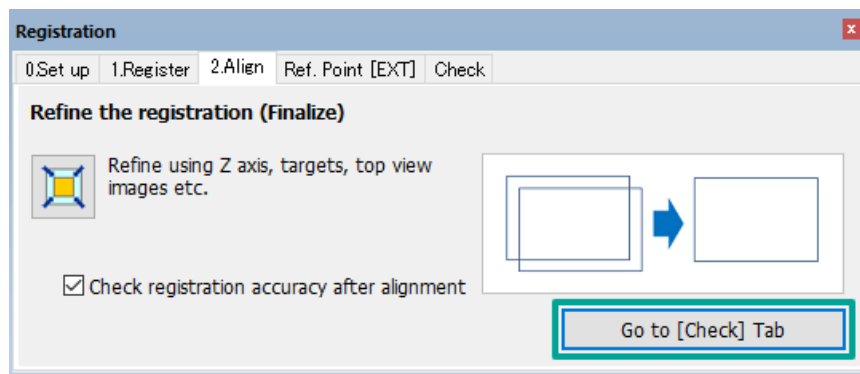


Please note that checking the accuracy of Registration is extremely important when using point clouds for engineering purposes such as measuring, drawing, and interference checking.



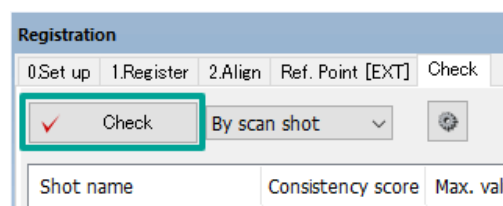
The check function may not detect all errors. Please ensure to **check visually** as well.

1. In [Registration (2.Align)] panel, click [Go to [Check] Tab].

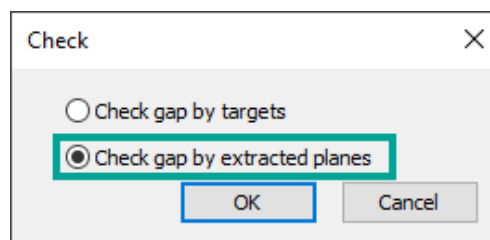


Enable "Check registration accuracy after alignment" in [2.Align] tab to automatically switch to [Check] tab after "Align All" is finished.

2. [Check] tab of [Registration] panel will appear. Click [Check].



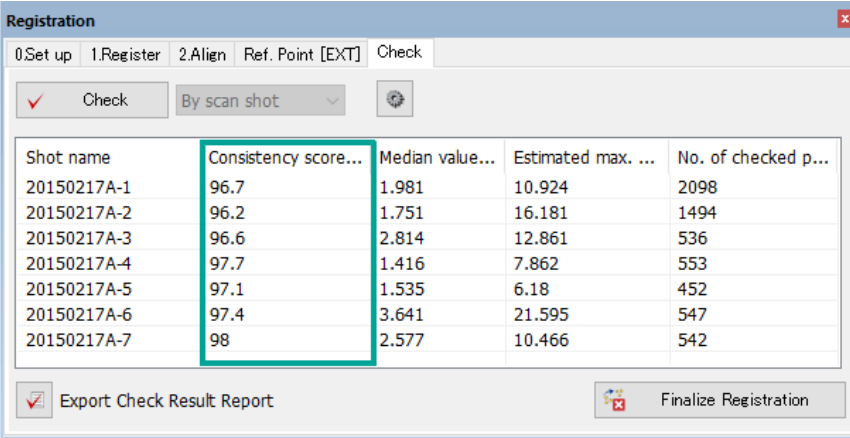
3. "Check" dialog will appear. Select "Check gap by extracted planes" and click [OK].



When scanning with targets in place, you can also use the targets to evaluate.

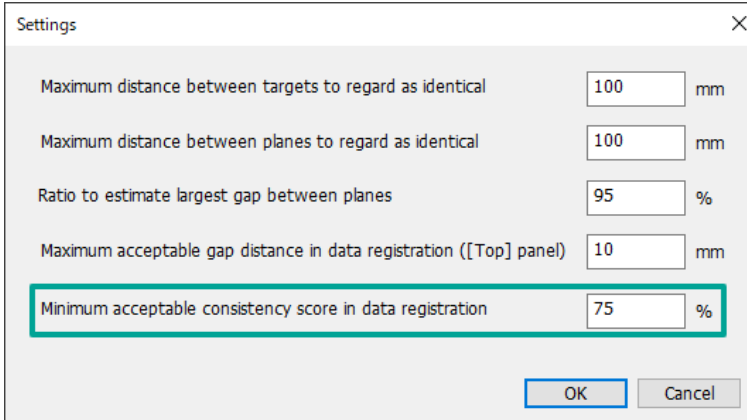
4. Select [Registration] panel > [Check] tab to display the evaluation result for each point cloud part on the list.

In "consistency score (mean) [%]", you can confirm the mean value of evaluated scores for registration consistency with adjacent scans.



Shot name	Consistency score...	Median value...	Estimated max. ...	No. of checked p...
20150217A-1	96.7	1.981	10.924	2098
20150217A-2	96.2	1.751	16.181	1494
20150217A-3	96.6	2.814	12.861	536
20150217A-4	97.7	1.416	7.862	553
20150217A-5	97.1	1.535	6.18	452
20150217A-6	97.4	3.641	21.595	547
20150217A-7	98	2.577	10.466	542

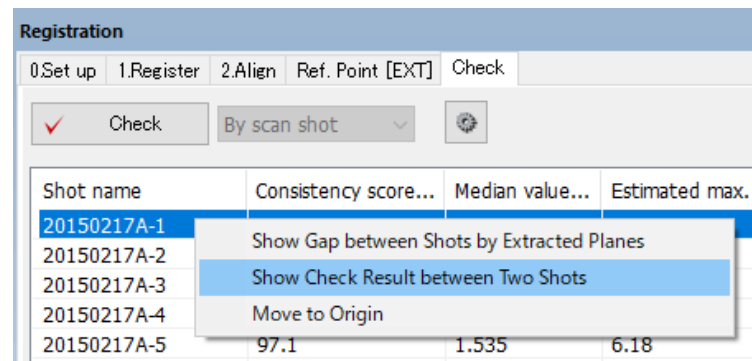
Consistency threshold is set at 75% by default. You can change the value in "Minimum acceptable consistency score in data registration" from the "Settings" dialog.

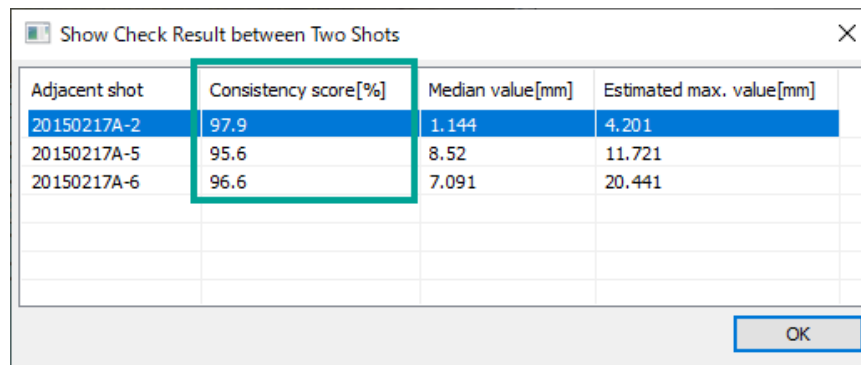
Maximum distance between targets to regard as identical	100	mm
Maximum distance between planes to regard as identical	100	mm
Ratio to estimate largest gap between planes	95	%
Maximum acceptable gap distance in data registration ([Top] panel)	10	mm
Minimum acceptable consistency score in data registration	75	%

- The median represents the value of gap which exists at 50% of the total number of gaps in the points to be evaluated.
- The estimated maximum value displays the largest gap value among 95% of all evaluated points, considering the remaining 5% of the total points as noise. The recommended estimated maximum value for registration is within 5 mm for indoors and within 10 mm for outdoors.

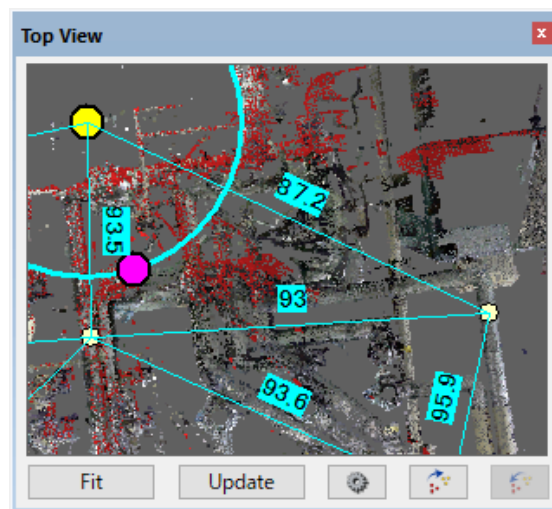
5. Right-click on the list, and select "Show Check Result between Two Shots" from the context menu.



A "Show Check Result between Two Shots" dialog will appear. In "consistency score[%]", you can confirm the value of evaluated scores for registration consistency per scan pair.



Also, the "consistency score (mean) [%] per scan pair" can be confirmed in [Top] panel.



If the evaluation result has not reached the normal value, both the cell and the text color of consistency score are displayed in red.

Consistency score (Mean)[%]	Median value[mm]	Estimated max. value[mm]
72	1.981	10.924
91.3	1.751	16.181
92.8	2.814	12.861
93.9	1.416	7.862
74	1.535	6.18
90.4	3.641	21.595
94.8	2.577	10.466

- If the value is lower than the threshold set at "Minimum acceptable consistency score in data registration", the text color of consistency will turn red.
- In "Show Check Result between Two Shots" dialog, when at least one consistency is lower than the threshold value set in "Minimum acceptable consistency score in data registration", the "consistency score (mean)" cell is highlighted in red.




Consistency score (Mean)[%]	Median value[mm]	Estimated max. value[mm]
72	1.981	10.924
91.3	1.751	16.181
92.8	2.814	12.861
93.9	1.416	7.862
74	1.535	6.18
90.4	3.641	21.595
94.8	2.577	10.466

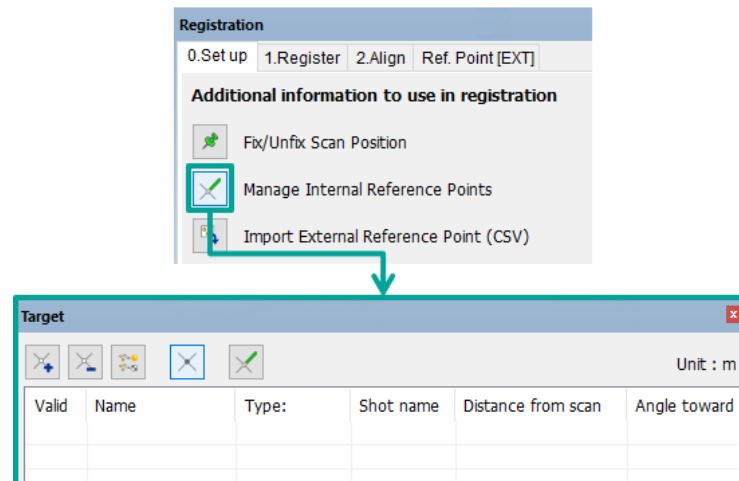
Show Check Result between Two Shots			
Adjacent shot	Consistency score[%]	Median value[mm]	Estimated max. value
20150217A-2	95.7	1.144	4.201
20150217A-5	35.2	8.52	11.721
20150217A-6	85.2	7.091	20.441


4.7. Finalize Registration

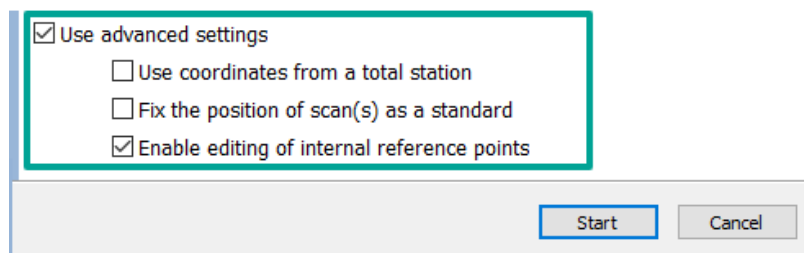
4.7.1. Extracting Targets (Internal Reference Points)

■ Create targets automatically (Checker board)

1. From the [Registration] panel > [0. Set up] tab, select the [Manage Internal Reference Points] () and open the [Target] panel.

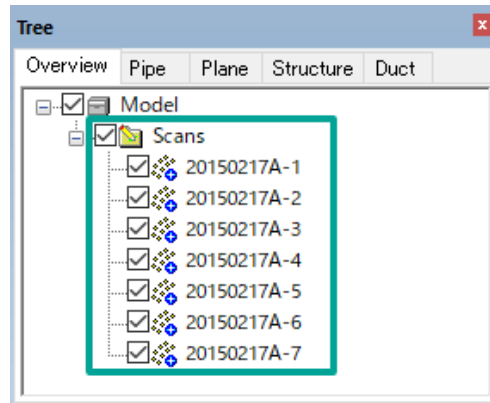


- Coordinates of checker board and/or spheres placed at the time of scan is defined as [Internal Reference Points].
- [Manage Internal Reference Points] () will be displayed in [0.Set up] tab of [Registration] panel only when the "Enable editing of internal reference points" is enabled in advanced settings at the start of the registration.

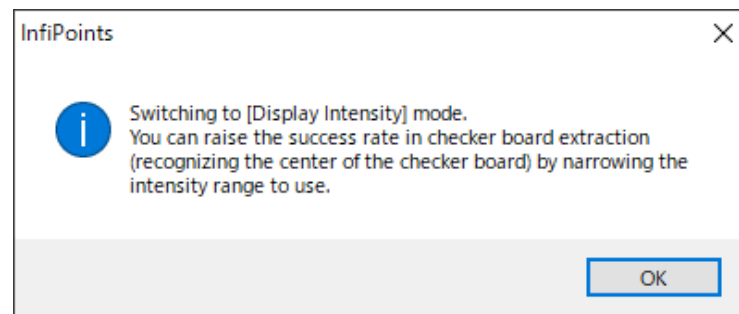


2. In [Target] panel, press [Extract] ().

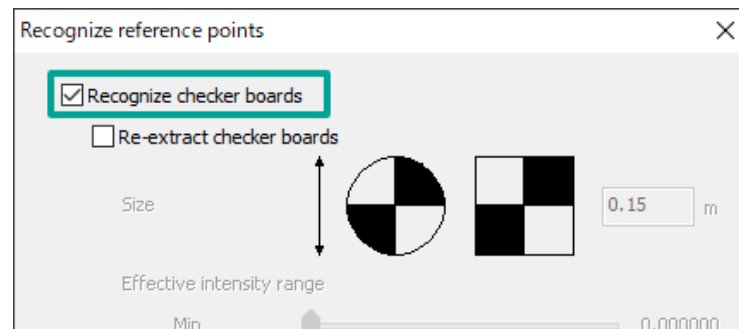
On [Tree (Overview)] panel, select the point cloud or point cloud group on which you want to create reference points.



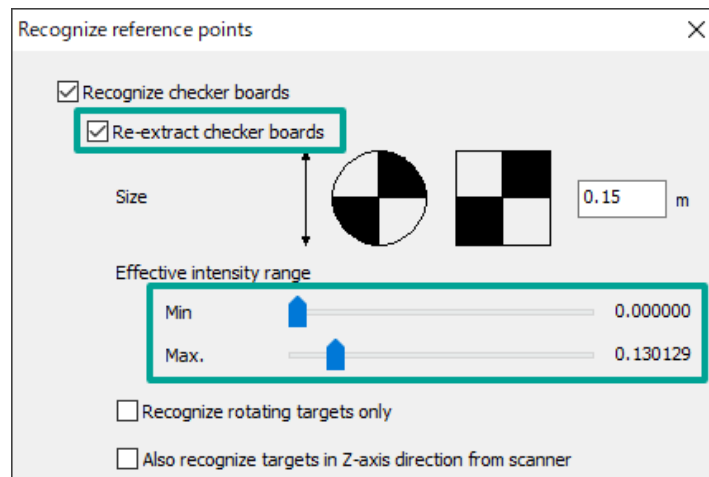
3. The following dialog will appear. Click [OK].



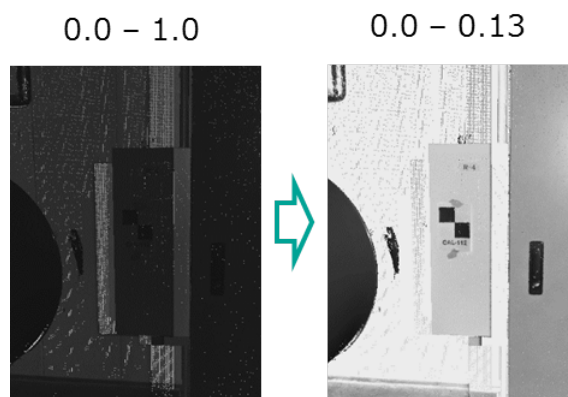
4. "Recognize reference points" dialog will appear. Enable "Recognize checker boards".



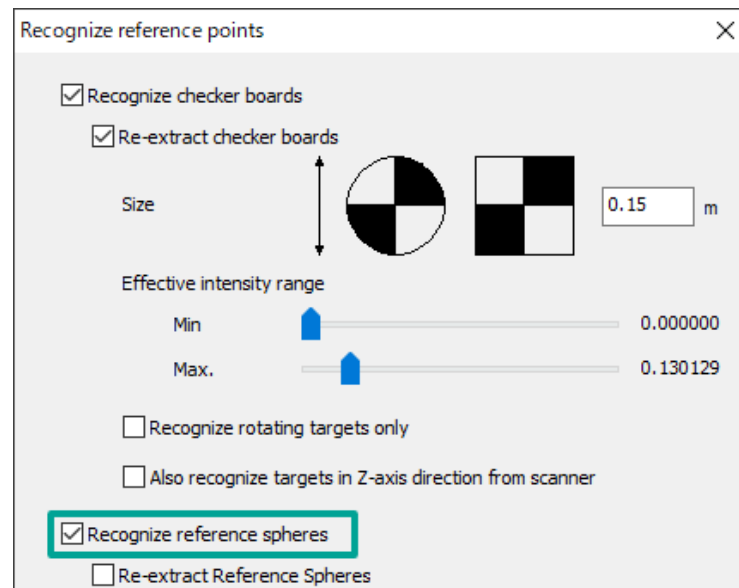
- If "Re-extract checker boards" is enabled, you can specify "Effective intensity range".
- Users can adjust the intensity range to distinguish the black and white appearance of the checker board.



- Example of using the Effective intensity range



5. When using a reference sphere, enable [Recognize reference sphere].

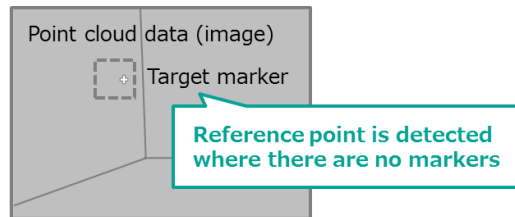


6. Click [OK] in "Recognize reference points" dialog. The target is extracted.

Target					
Valid	Name	Type:	Shot name	Distance from scan	Angle to
<input checked="" type="checkbox"/>	20150217A-5 - 1	Checker Board	20150217A-5	1.626	29.103
<input checked="" type="checkbox"/>	20150217A-5 - 2	Checker Board	20150217A-5	1.628	65.157
<input checked="" type="checkbox"/>	20150217A-5 - 3	Checker Board	20150217A-5	1.632	69.597






- Within the extracted reference points, check for over detection or under detection of points.

(Ex.) Over detection



Delete reference points at the [structure] panel

- Return back to the [Registration] panel by selecting [Finish Editing Internal Reference Points]  in the [Target] panel.

Target			
			
			
Valid	Name	Type:	Shot name
<input checked="" type="checkbox"/>	20150217A-5 - 1	Checker Board	20150217A-5
<input checked="" type="checkbox"/>	20150217A-5 - 2	Checker Board	20150217A-5



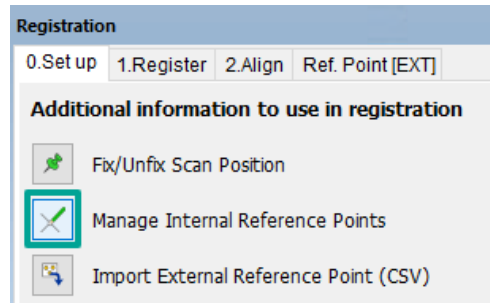
Case A: Execute "[Import External Reference Points](#)"

Case B/C/D: Proceed to "[Regist Auto](#)"

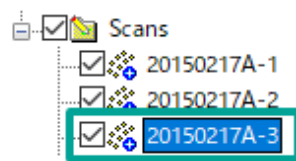
Please refer to "[Registration Using InfiPoints](#)" for each "Case".

■ Create targets manually (Checker Board)

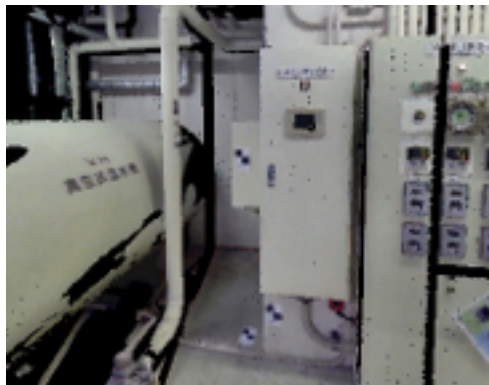
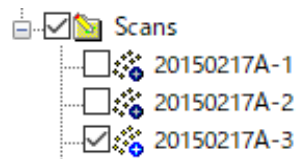
1. From [Registration (0. Set up)] panel, select [Manage Internal Reference Points] ().



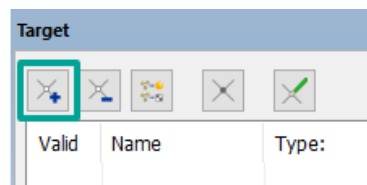
2. Select a scan shot to create targets from in [Tree (Overview)] panel.



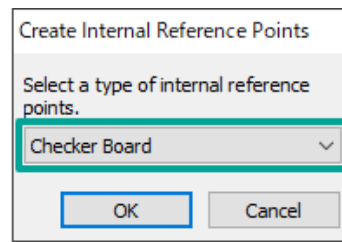
Only the selected scan shot is displayed on "3D View" window, and the center of the viewpoint will shift to the origin of the selected scan shot.



3. Press [Add] () on [Target] panel.

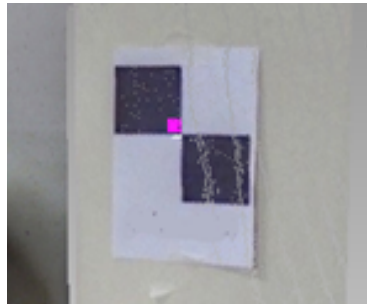


4. "Create Internal Reference Points" dialog will appear so specify a target type. In this case, specify "Checker Board", and click [OK].

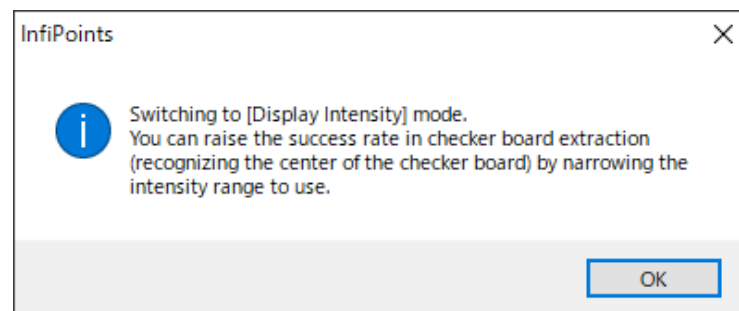


"Reference Sphere" and "Free Hand" are also selectable as a target type.

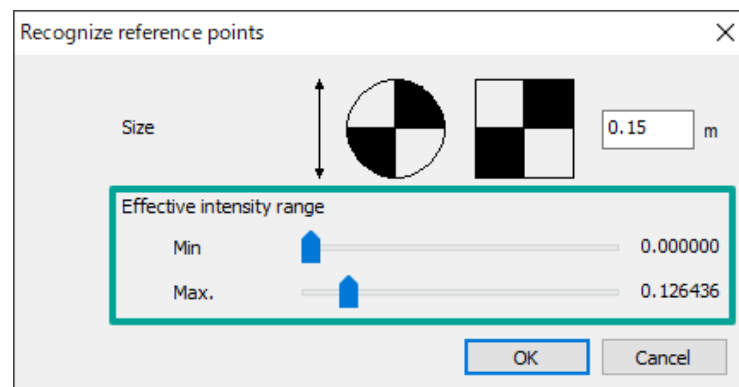
- Click a point on "3D View" window to create a target; this time, click around the center of the checker board.



- The following dialog will appear. Click [OK].
Display mode of "3D View" window will switch to "Display Intensity" mode.

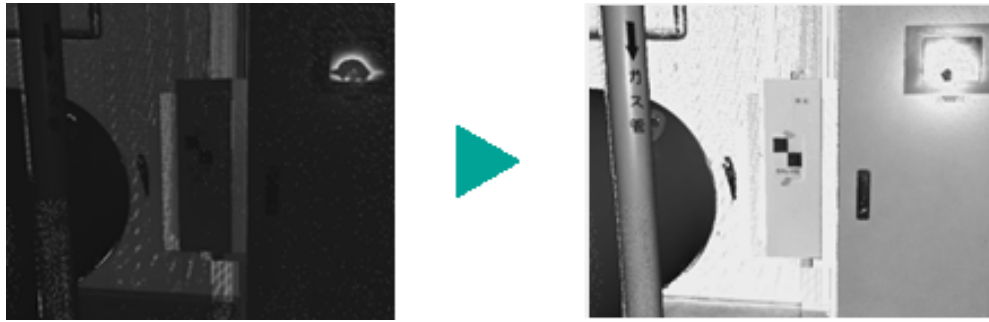


- "Recognize reference points" dialog will appear. Adjust the effective intensity range by moving the slider in the dialog to clearly distinguish black part and white part.

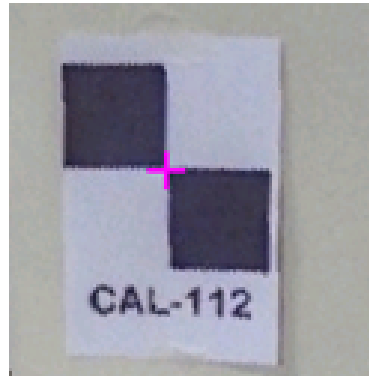


The intensity in "3D View" window changes as you move the slider.


(Example) Min. 1.0 → Max. 0.13




Adjust the Effective intensity range and click [OK] to add the target.

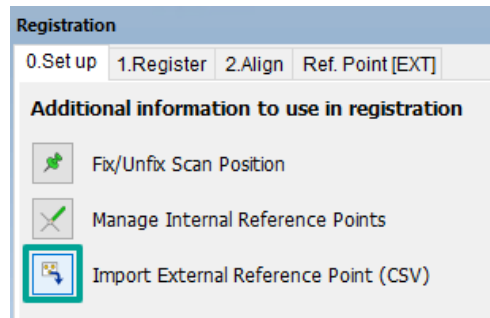



Targets are added for each scan shot and can be checked on the target panel.

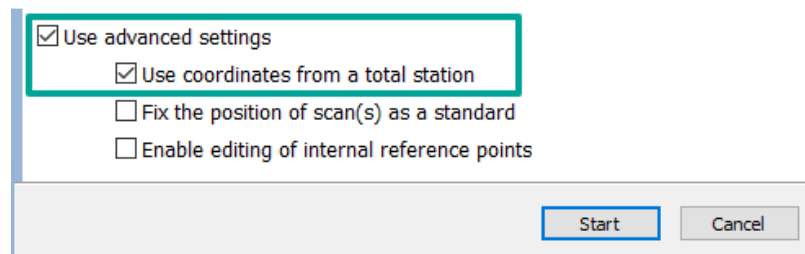
Target			
			
Valid	Name	Type:	Shot name
<input checked="" type="checkbox"/> 2	20150217A-3 - 2	Checker Board	20150217A-3
<input checked="" type="checkbox"/> 3	20150217A-3 - 3	Checker Board	20150217A-3
Registration Target			

4.7.2. Importing the External Reference Points

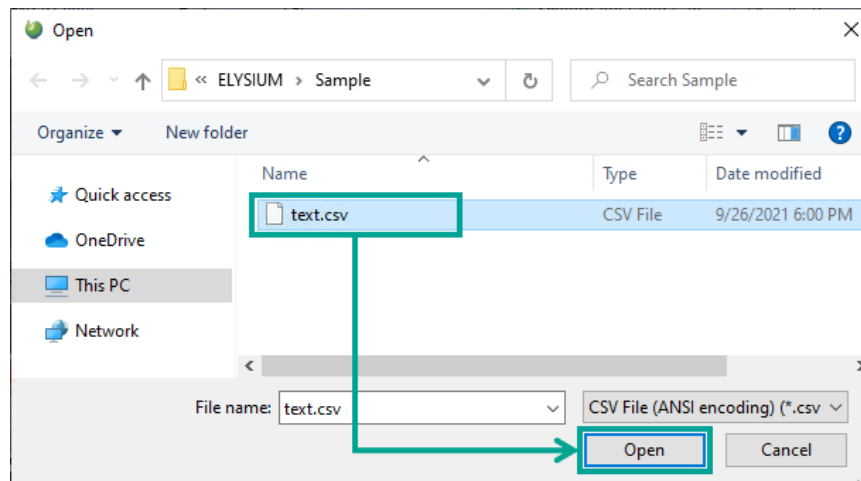
1. From the [Registration] panel > [0. Set up] tab, select the [Import External Reference Point (CSV)] .



[Import External Reference Point(CSV)] () will be displayed in [0.Set up] tab of [Registration] panel only when the "Use coordinates from a total station" is enabled in advanced settings at the start of the registration.



2. Specify the coordinate file (.csv) from the survey and click [Open].



- The reference points made in InfiPoints will automatically fit to the imported coordinates.



- In order to import external reference points, you need to prepare beforehand.
- Match the internal reference points to the external reference points to increase the accuracy of the registration.

External reference point preparation

Create a CSV file of surveyed coordinates to import them into InfiPoints.

Name	X coordinate (m)	Y coordinate (m)	Z coordinate (m)
A0	0.0450	0.8790	0.0010
A1	0.0000	0.0000	1.7870
A2	0.0000	0.0040	0.4940
A3	-4.2390	2.9780	0.2790
A4	0.1060	5.6840	1.2750
A5	4.3880	3.6720	1.9530
B1	25.5160	-9.0510	0.5280
B2	19.9600	-13.2990	0.3960
B3	16.3430	-8.5650	0.3220
B4	24.0720	-4.3960	1.8390
C1	8.9570	23.3730	1.1140



Create a CSV file based on the x,y,z coordinates of every target point

Survey_coordinatest_m.csv - Notepad

File Edit Format View Help

A1,0.000,0.000,1.787
 A2,0.000,0.004,0.494
 A3,-4.239,2.978,0.279
 A4,0.106,5.684,1.275
 A5,4.388,3.672,1.953

	A	B	C	D
1	A1	0	0	1.787
2	A2	0	0.004	0.494
3	A3	-4.239	2.978	0.279
4	A4	0.106	5.684	1.275
5	A5	4.388	3.762	1.953

1 row per target point (point name, x, y, z)




Importing units of the reference points will be determined by the settings in [Application Menu] > [Option] > [System Settings] > [Miscellaneous] > [Length Units].

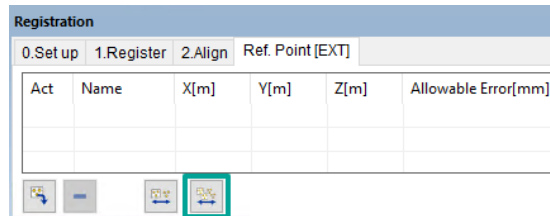


Please ensure that CSV file unit system and InfiPoints unit system (meters, etc.) are the same.

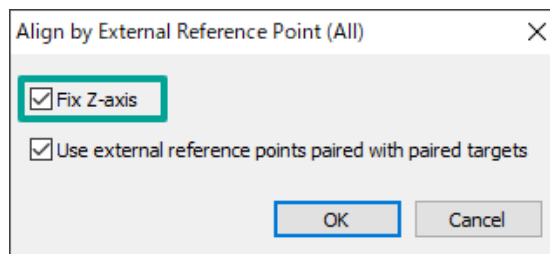
4.7.3. Aligning by External Reference Points

This is a function to import the coordinate value of external reference points (survey information of reference spheres / checker boards), and align shots (adjust their position and angle) to achieve the registration accuracy that compares to that of survey.

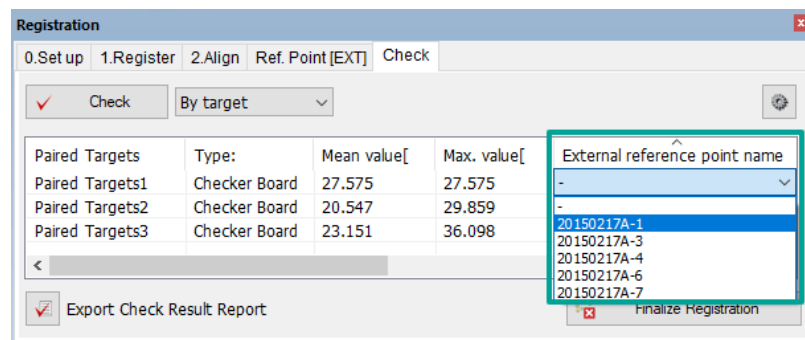
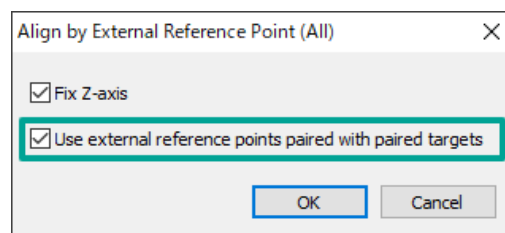
1. In [Registration (Ref. Point [EXT])] panel, press [Align by External Reference Point (Point Cloud Group)] (). "Align by External Reference Point (All)" dialog will appear.



2. To keep the Z-axis, enable "Fix Z-axis" and then click [OK].

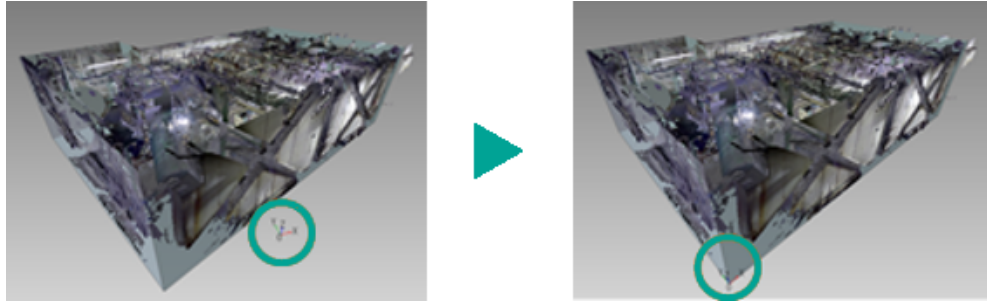


If the external reference points are specified for the target group in [Registration (Check)] panel, and if "Use external reference points paired with paired targets" is enabled in "Align by External Reference Point (All)" dialog, the specified external reference points are forced to be the corresponding points.



Shots will be aligned.

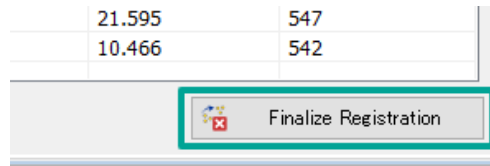
e.g., Set world coordinates (0,0,0) to the left corner of the building



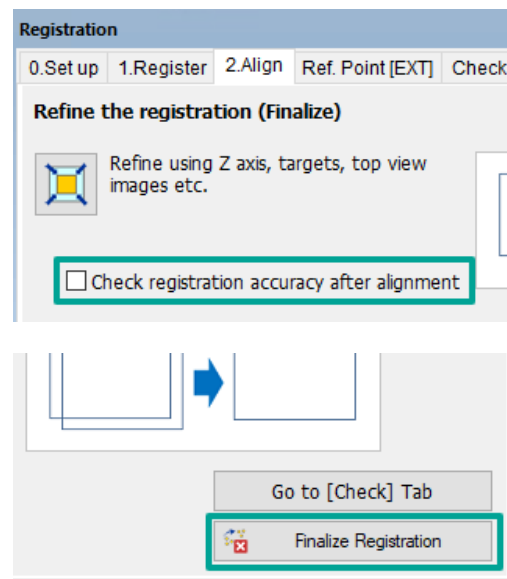
Please ensure that each shot has at least three targets that correspond to external reference points (or two when "Fix Z-axis" option is enabled).

4.8. Finalize Registration

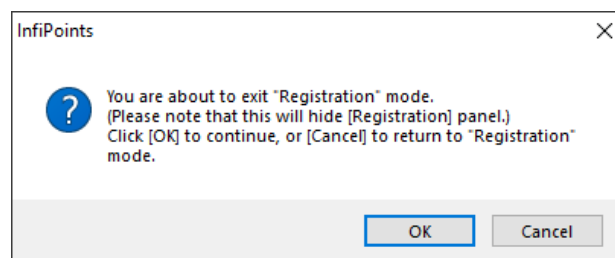
1. In [Registration (Check)] panel, click [Finalize Registration].



To finish Registration without performing any checks, disable "Check registration accuracy after alignment" option in [Registration [2.Align)] panel and click [Finalize Registration].



2. The following dialog will appear. When you click [OK], Registration will finish, and both [Registration] and [Target] panels will be hidden.



4.9. Defining the Origin

To define significant coordinates in the point cloud data, it is necessary to define the origin and axis. There are two methods, [By Selecting 3 Planes] and [By Selecting 2 Points].

About defining the origin


The key is whether to keep the original Z-axis from the scanned data or not. Decide whether to choose planes or points depending on the data.

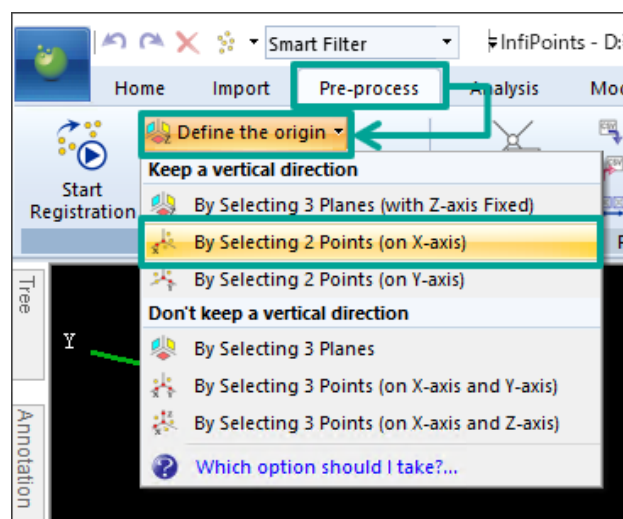
- If the scanned data has a reliable Z-axis
 - By Selecting 3 Planes (With Z-axis fixed)
 - By Selecting 2 Points (on X-axis)
 - By Selecting 2 Points (on Y-axis)
- If the scanned data does not have a reliable Z-axis
 - By Selecting 3 Planes
 - By Selecting 3 Points (on X-axis and Y-axis)
 - By Selecting 3 Points (on X-axis and Z-axis)



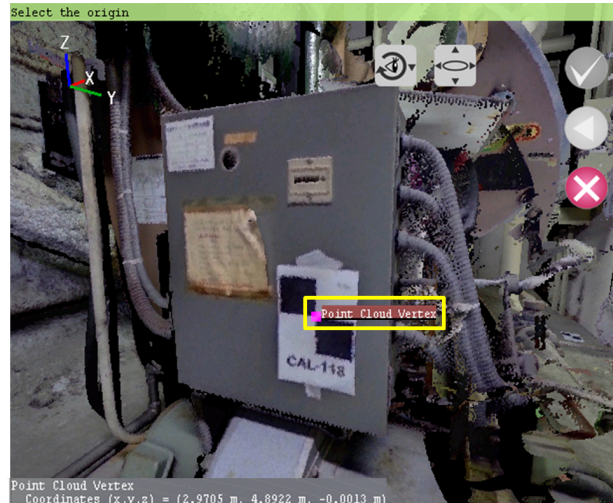
If the origin is defined using planes, plane models are required. Perform [[Extract Planes and Pipes](#)] in the [Pre-process] tab beforehand.

4.9.1. Selecting 2 points maintaining the z-axis direction

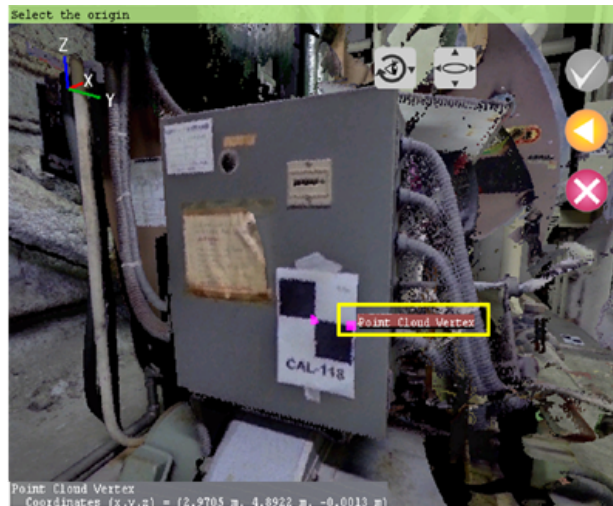
1. Select [Pre-process] tab > [Register] > [Define the origin] > [By Selecting 2 Points (on X-axis)] ().



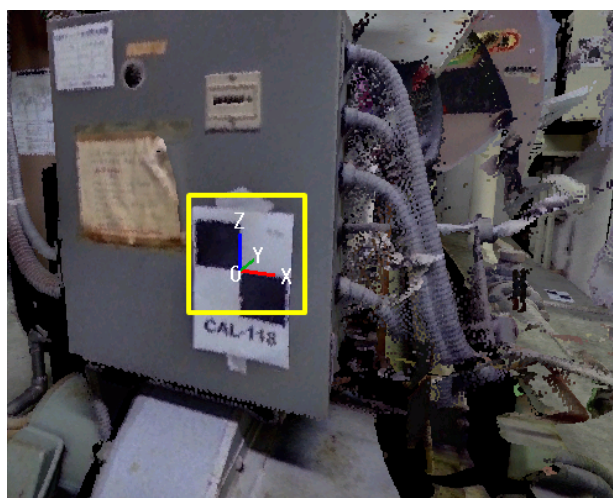
2. Select point (A) close to the location where the origin will be specified.



3. Select a certain point (B) on the X-axis direction.

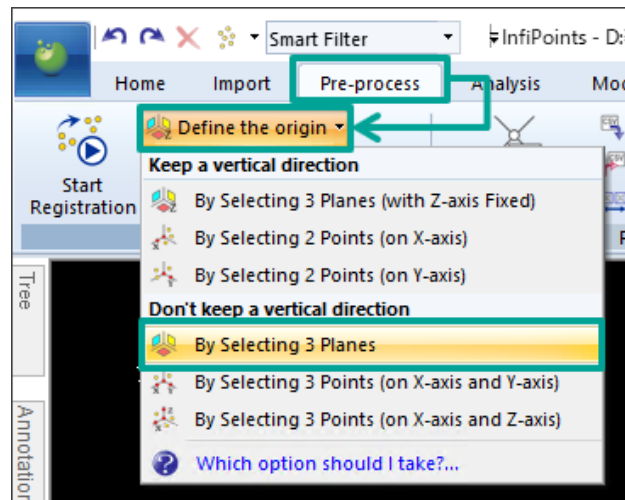


Origin will be set maintaining the Z-axis direction with point (A) as center and point (B) along the X-axis direction.

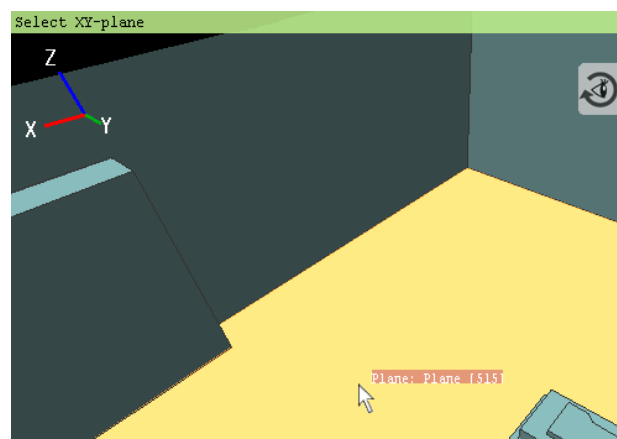


4.9.2. Selecting 3 planes

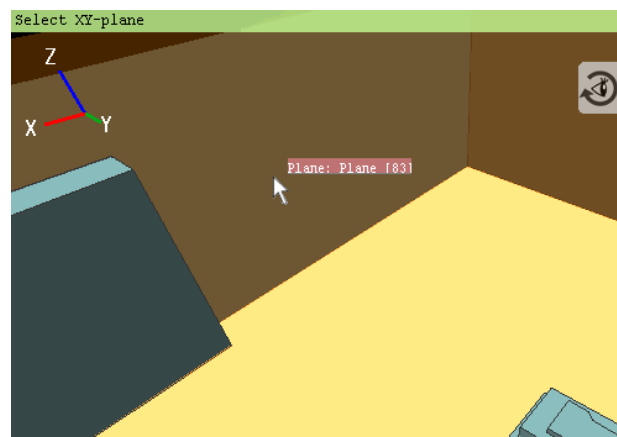
1. Select [Pre-process] tab > [Register] > [Define the origin] > [By Selecting 3 Planes] ().



2. Select a plane to be the XY-plane on 3D View Window.

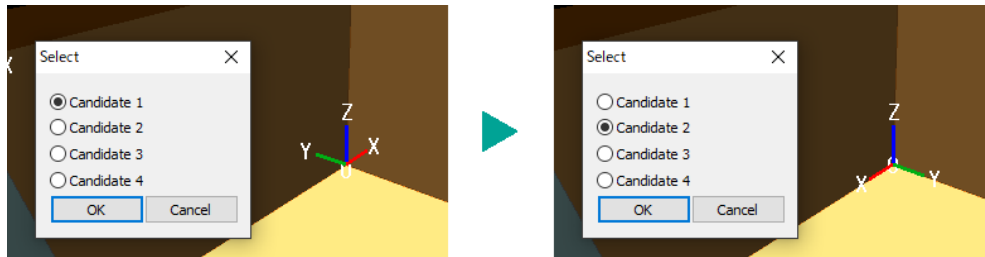


3. Select planes to be YZ-plane and ZX-plane on the 3D View Window in the same way.

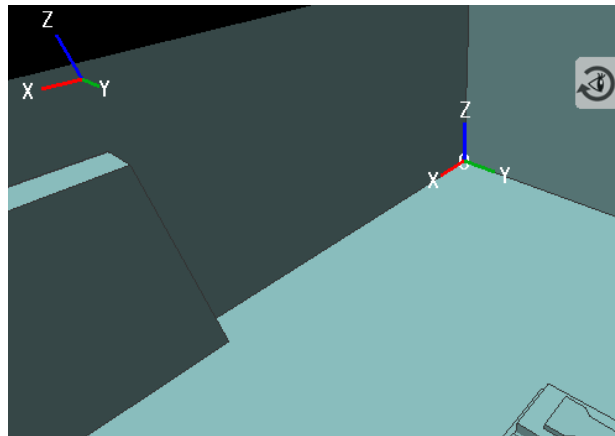


Please note that only planes almost perpendicular to the already selected XY-plane can be selected as YZ-plane and ZX-plane.

4. "Select" dialog will appear. As the candidate changes, the direction of the coordinate in 3D View Window changes accordingly. Select a candidate and click [OK].



The coordinate is transformed so that the selected planes become the XY-plane, YZ-plane, and ZX-plane according to the order selected.





4.10. Translating Coordinates to Match Surveyed Coordinate Data

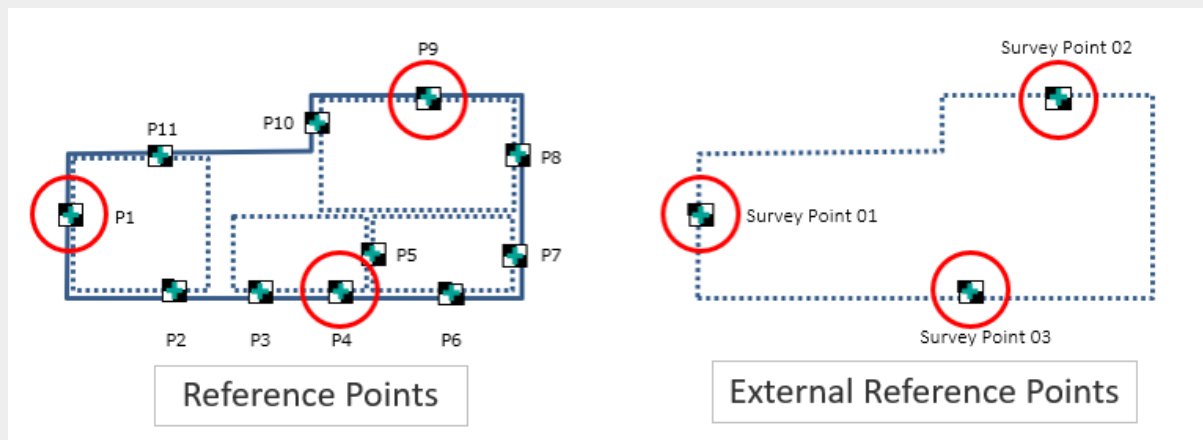
Coordinates of the entire project are adjusted by matching the reference points set in Elysium InfiPoints with the coordinates surveyed by the total station, etc.

Coordinate Translation

To translate the coordinates of an entire project, you need "Reference points", which are created from point cloud in Elysium InfiPoints, and "External reference points", which are coordinates measured by surveying instrument such as a total station and saved in CSV file format.

When using [Import External Reference Points] () to translate coordinates, there must be at least three reference points and at least three external reference points each. However, when using [Import (with Z-axis Fixed)] () to translate coordinates with z-axis fixed, there must be at least two each.

Set the reference points and external reference points so that they are in the same relative position as shown in the figure below.




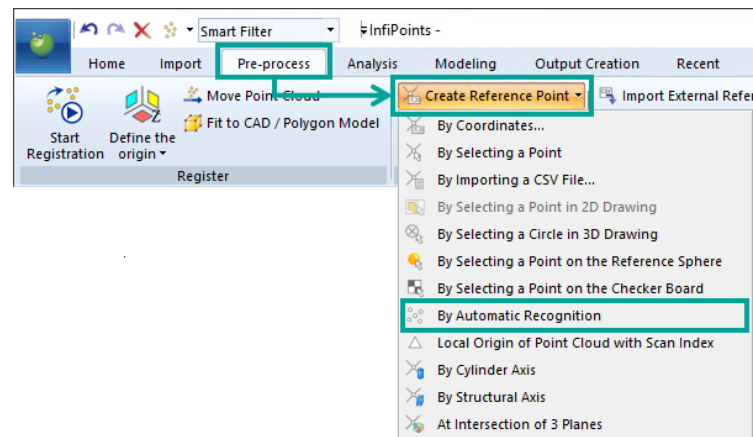
4.10.1. Creating Reference Points

Create a reference point at the point surveyed by the total station, etc.

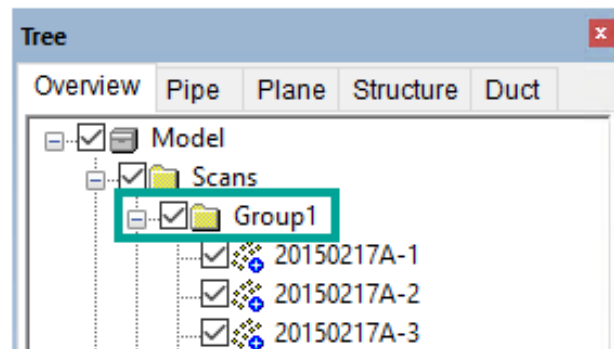
■ Create Reference Point (By Automatic Recognition)

Here, as an example, the checkerboard is automatically detected and the reference point is set.

1. Select [Pre-process] tab > [Reference Point] > [Create Reference Point] > [By Automatic Recognition] () from the Ribbon menu.

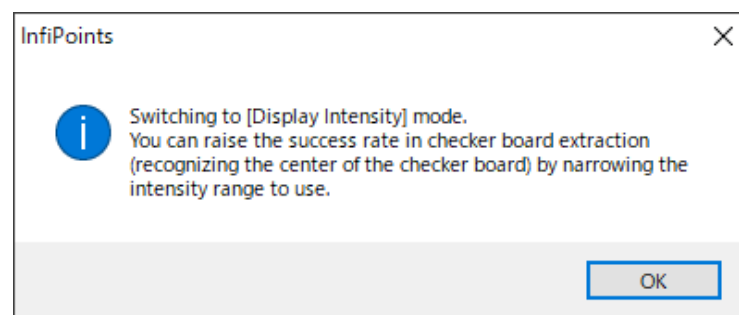


2. Select a point cloud group () to create reference points from [Tree (Overview)] panel.

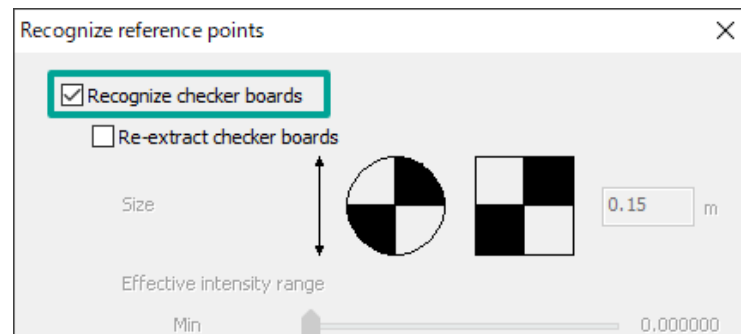


- Select the [Scans] folder when defining the entire point cloud.
- Different from the scan shot unit "target (internal reference point)", "reference point" will be created for each point cloud group.

3. The following dialog will appear. Click [OK].
Display mode on "3D View" window switches to "Display Intensity" mode.

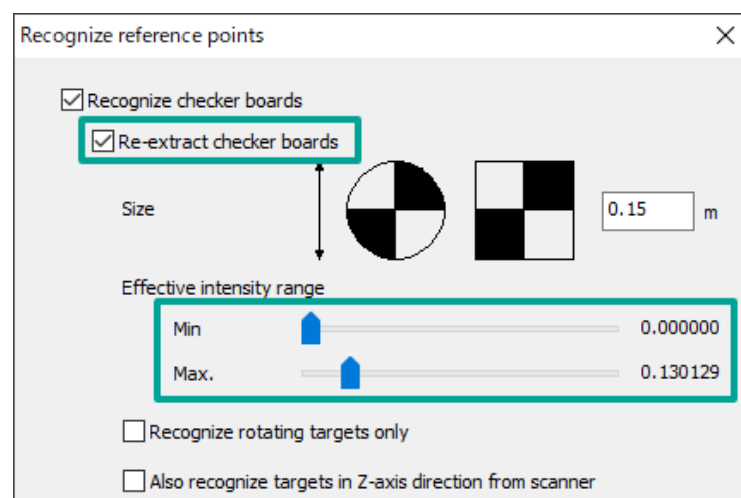


4. "Recognize reference points" dialog will appear. Enable [Recognize checker boards].

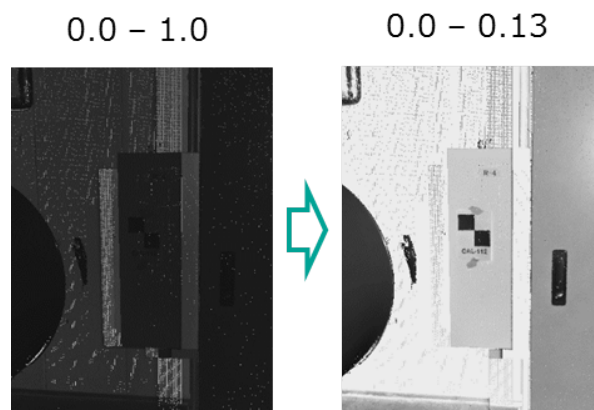


5. Enable "Re-extract checker boards".

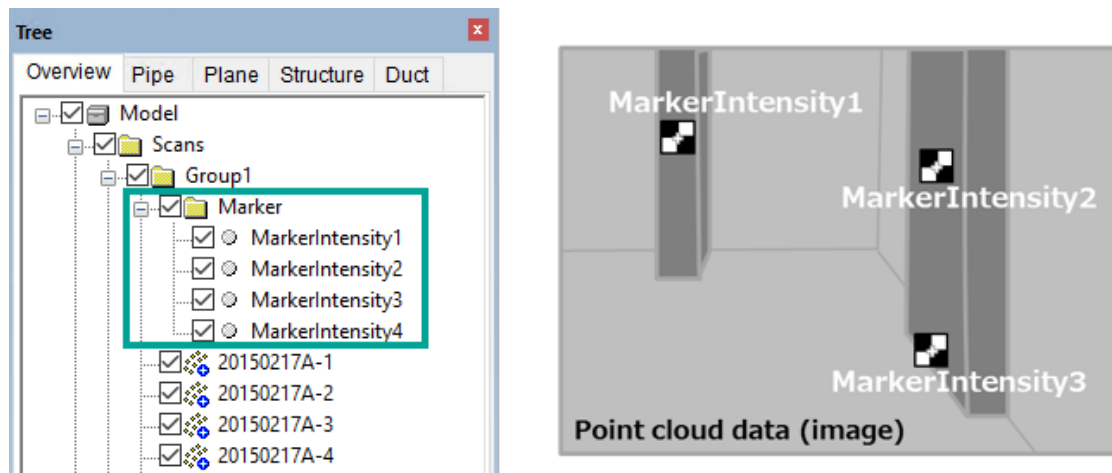
On "3D View" window, adjust the minimum and maximum values of "Effective intensity range" so that the black and white pattern on the checkerboard can be identified while checking the displayed reflection intensity.



- Example of using the Effective intensity range

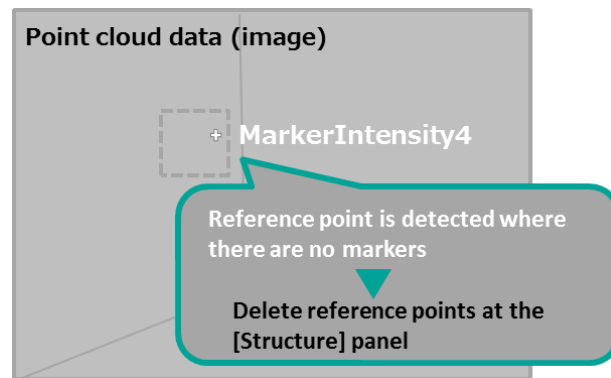


6. Click [OK] in "Recognize reference points" dialog. Reference point will be created at the center of the checker board.

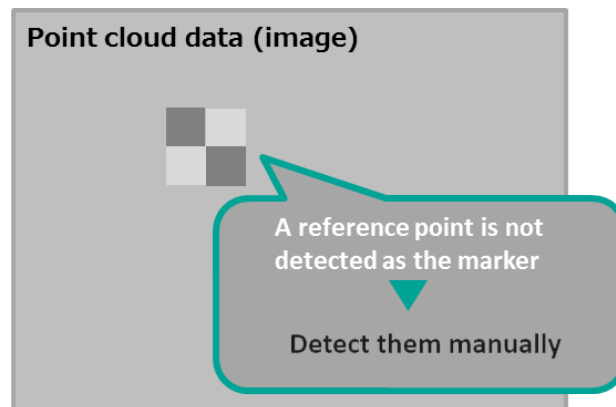


7. On "3D View" window, confirm the automatically detected reference points. If there are over-detection or under-detection, modify them.

(Ex.1) Over detection → Delete reference points at the [Tree (Overview)] panel




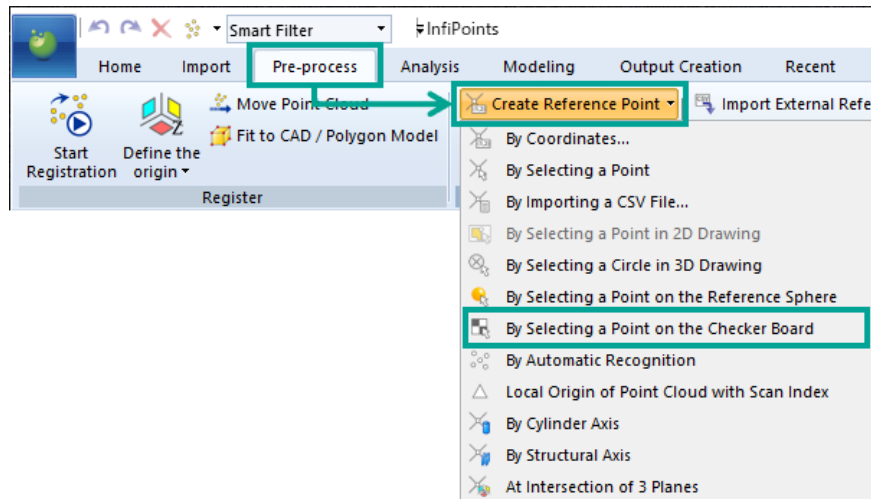
(Ex.2) Under detection → Manually detect the points




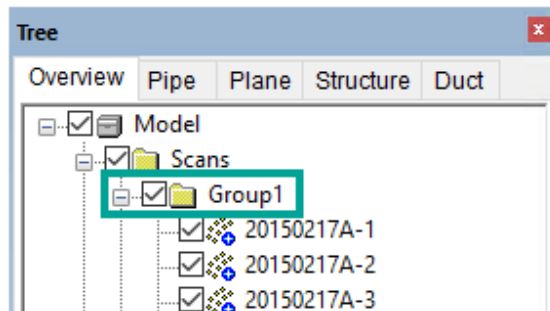
■ Create Reference Point (By Manual Recognition)

Manually recognize the checkerboard that was not detected automatically and set the reference point.

1. Select [Pre-process] tab > [Reference Point] > [Create Reference Point] > [By Selecting a Point on the Checker Board] () from the Ribbon menu.

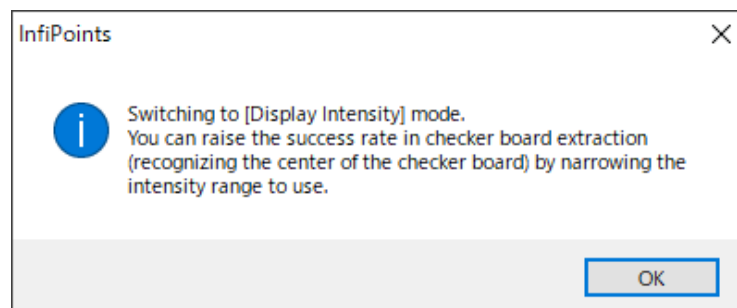


2. Select a point cloud group () to create a reference point in [Tree (Overview)] panel.

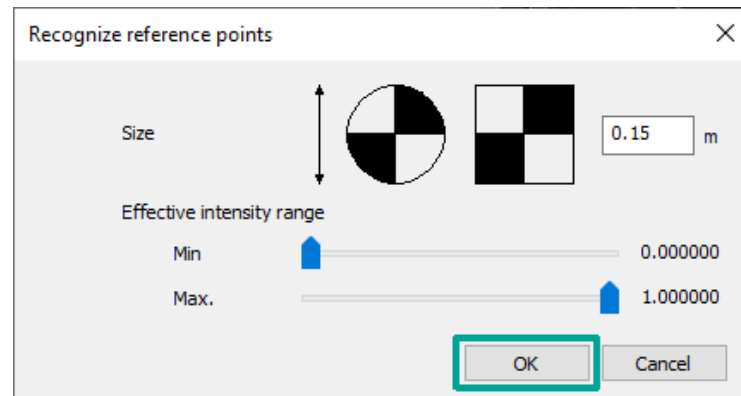


Select the [Scans] folder when defining the entire point cloud.

3. The following dialog will appear. Click [OK].
Display mode on "3D View" window switches to "Display Intensity" mode.



- "Recognize reference point" dialog will appear.
Adjust the marker size and effective intensity range, and click [OK].



- Select the center of the marker.















Reference point is created at the center of the marker.



If a reference point is not created, adjust the size of marker and the effective intensity range in "Recognize reference points" dialog, and select the point cloud near the center of the marker again.

[Reference] List of Commands for Creating Reference Points

 By the coordinates	This is to create by specifying a point by the coordinate value. This is ideal to create reference points at exactly where you wish to.
 By selecting a point	This is to create by specifying a point in point clouds.
 By importing a CSV file	This is to create by importing the name and the coordinate value of reference points from CSV file.
 By selecting a point in 2D drawing	This is to create by specifying a point in 2D drawing.
 By selecting a circle in 3D Drawing	This is to create at the center of the circle by picking the circle (drawing element) in the 3D View window.
 By selecting a point on the reference sphere	This is to create by specifying a point on reference spheres by the radii. There are two methods to specify the radii: calculating from the geometry or inputting the value if you know.
 By selecting a point on the checker board	This is to create by specifying a point on checker boards.
 By automatic recognition	This is to create by recognizing checker boards / reference spheres automatically. The reference points will be created where the white and black cross orthogonally for the checker boards, and at the center point of the sphere for the reference spheres.
 By the origin from the scanning	This is to create by specifying the scanner position (origin). This is available for the point cloud data with scan index.
 By Cylinder axis	This is to create at the specified distance along a cylinder from either connection part (except "Joint") or an existing reference point by specifying the Cylinder.
 By Structural axis	This is to create at the specified distance from either an end point of the Structural axis, or an existing reference point by specifying the Structure.
 At intersection of 3 planes	This is to create at the intersection point of 3 selected planes.

4.10.2. Matching Reference Points with Surveyed Coordinate Data (CSV)

The entire coordinates are translated according to the coordinate values of the measurement points surveyed by the Total Station, etc.

Preparation

- Create a CSV file to import the survey instrument coordinates into InfiPoints.

Name	X coordinate (m)	Y coordinate (m)	Z coordinate (m)
A0	0.0450	0.8790	0.0010
A1	0.0000	0.0000	1.7870
A2	0.0000	0.0040	0.4940
A3	-4.2390	2.9780	0.2790
A4	0.1060	5.6840	1.2750
A5	4.3880	3.6720	1.9530
B1	25.5160	-9.0510	0.5280
B2	19.9600	-13.2990	0.3960
B3	16.3430	-8.5650	0.3220
B4	24.0720	-4.3960	1.8390
C1	8.9570	23.3730	1.1140

Create a CSV file based on the x,y,z coordinates of every target point

Survey_coordinatest_m.csv - Notepad

File Edit Format View Help


A1,0.000,0.000,1.787
 A2,0.000,0.004,0.494
 A3,-4.239,2.978,0.279
 A4,0.106,5.684,1.275
 A5,4.388,3.672,1.953

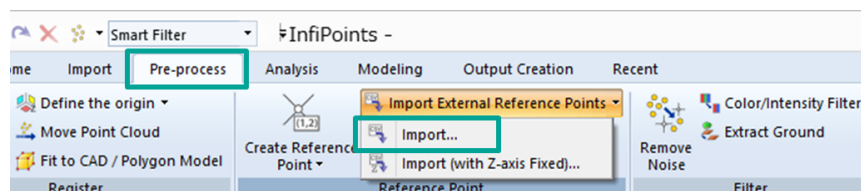
	A	B	C	D
1	A1	0	0	1.787
2	A2	0	0.004	0.494
3	A3	-4.239	2.978	0.279
4	A4	0.106	5.684	1.275
5	A5	4.388	3.762	1.953

1 row per target point (point name, x, y, z)

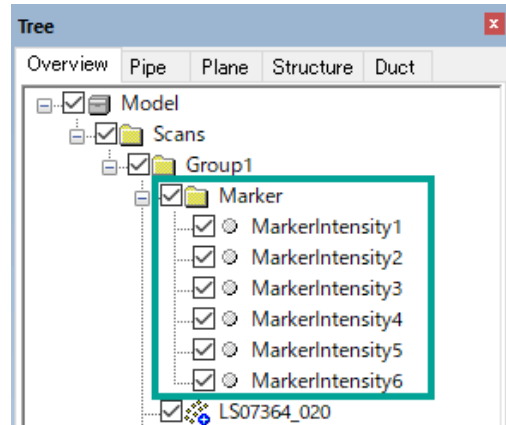


Coordinates will be imported as the same measurement units as seen in [System Settings] > [Miscellaneous] > [Length units].
 Be sure to match the units such as meters and millimeters.

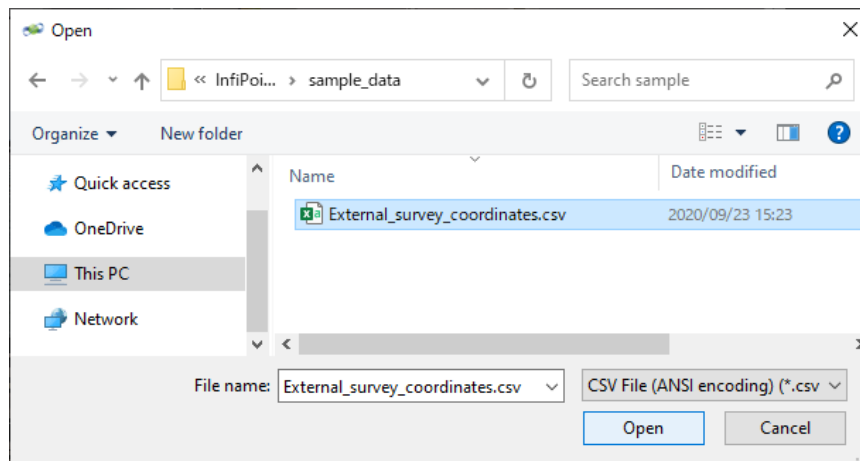
1. Select [Pre-process] tab > [Reference Point] > [Import External Reference Points] > [Import] () from the Ribbon menu.



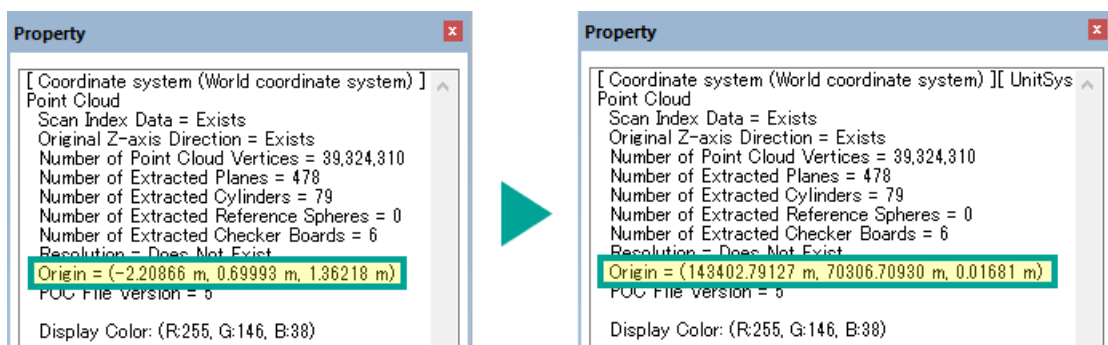
Please note that at least three reference points (or two if Z-axis is fixed) that have the same positional relationship as the external reference points are required beforehand.



2. "Open" dialog will appear. Specify the CSV file created in [Preparation] and click [Open].




Coordinate information written in the CSV file is imported, and the coordinates of the entire model are translated so that the reference points match the imported coordinate values.

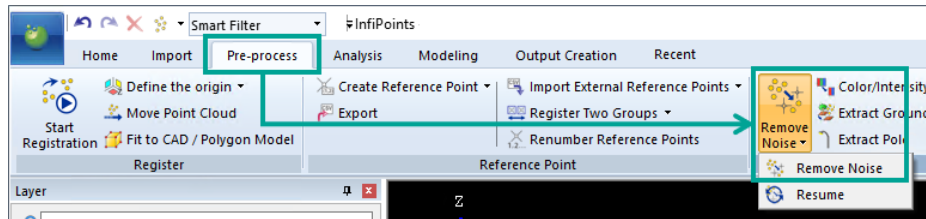


5. Removing Noise

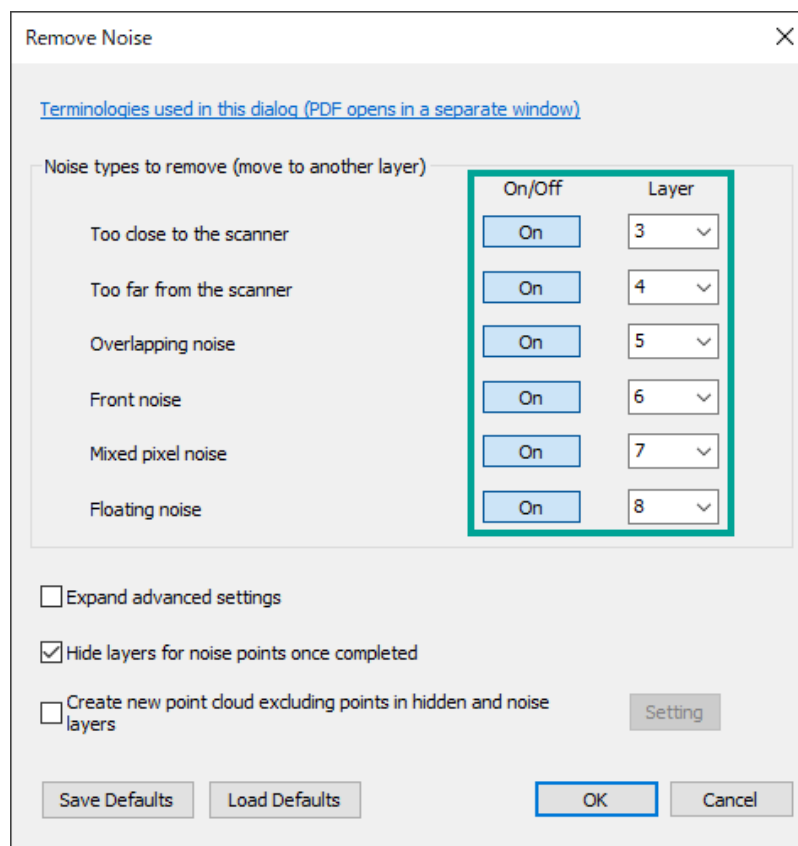
When scanning, unintended subjects such as human figures and other moving objects and floating objects can be captured also. InfiPoints automatically detects and removes those points.

5.1. Removing Noise (Auto Recognize)

1. Select [Pre-process] tab > [Remove Noise] > [Remove Noise] () from the ribbon menu.



2. "Remove Noise" dialog will appear. Switch the status of "On/Off" to On for each item of "Noise types to remove" to specify the layer to which the noise is moved. At the same time, an unused layer number is automatically assigned to the target layer.

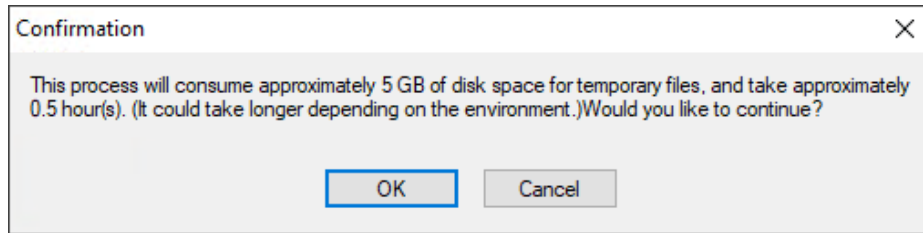


- The process will be skipped when a layer is not selected.
- Enable "Create new light point cloud data excluding points in invisible and noise layers" to create a new filtered point cloud data without hidden layers and noise layers.
- Enable "Hide layers for noise points once completed" to hide the layer that was specified as the target to store noise after removing noise.



Remove Noise function is only available with point cloud imported from FLS (FWS), ZFS and PTX.

3. When clicking [OK], a confirmation dialog will appear.

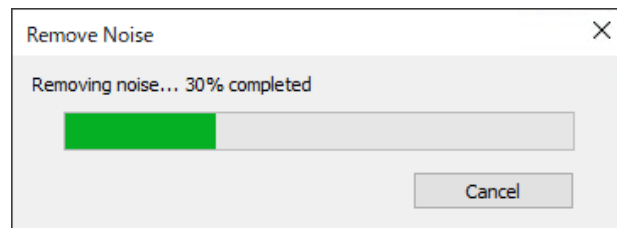


A large temporary file is created with the noise reduction process. A rough estimate of the disk memory would be shown, so please make sure that the designated [Work] folder has enough memory capacity.

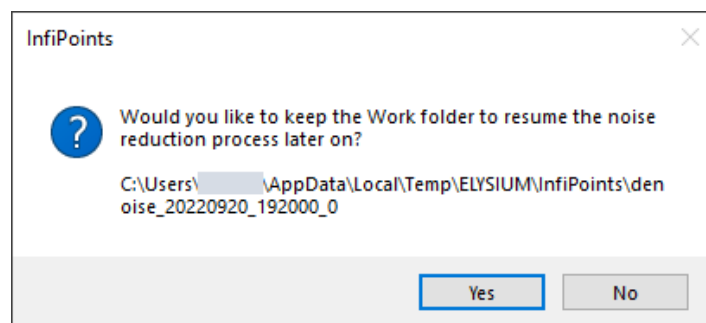
How to check the [Work] folder: [Application Menu] > [Option] > [System Settings] > [Path] > [Work]

4. By clicking [OK] in the confirmation dialog, noise reduction will start.

Progress of noise reduction can be confirmed on the progress bar in the dialog. Also, you can click [Cancel] to pause the process.



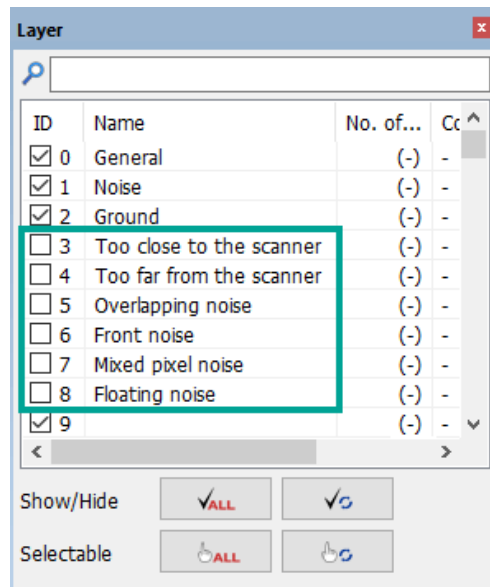
Please note that the following dialog will appear during the interruption process of noise reduction. Click [Yes] to save the Work folder. By opening the Work folder with [Resume] (🔄), you can resume noise reduction from where you left off.



* Please refer to [5.2, “Resuming Noise Reduction”](#) for details about resuming noise reduction.

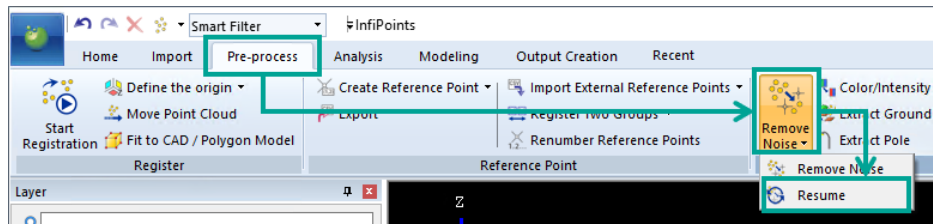
5. Once the noise reduction finishes, point cloud data classified as noise will be moved to specified layers.

If the option "Hide layers for noise points once completed" is enabled in "Remove Noise" dialog, the layer specified as noise will be hidden.

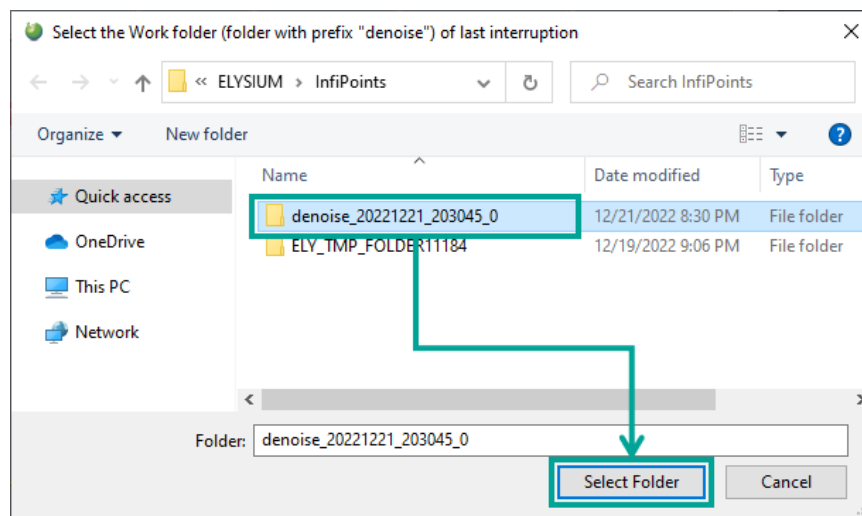


5.2. Resuming Noise Reduction

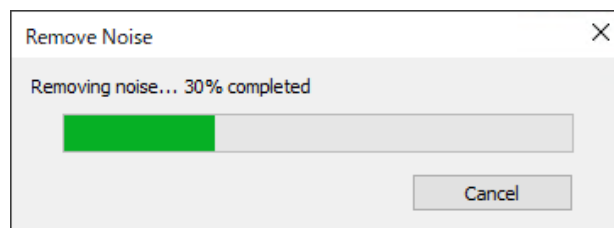
1. Select [Pre-process] tab > [Remove Noise] > [Resume] () from the ribbon menu.



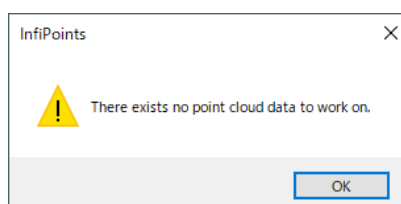
2. The following dialog will appear. Specify the folder which you saved during the last interruption of noise reduction (a folder whose name begins with "denoise"), and then click [Select Folder].



Noise reduction will resume from where it left off.

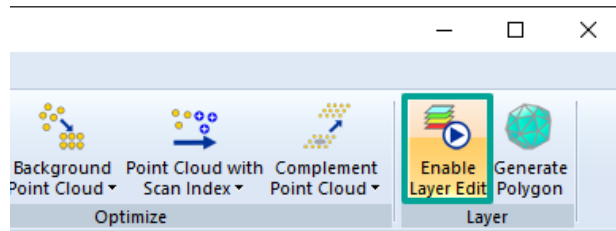


If you try to resume noise reduction when the display state (show / hide) of the point cloud part is different from the display state when noise reduction was interrupted, the following dialog will appear. If this dialog appears, adjust the display state of the point cloud part to the one when noise reduction was interrupted, and then resume noise reduction.

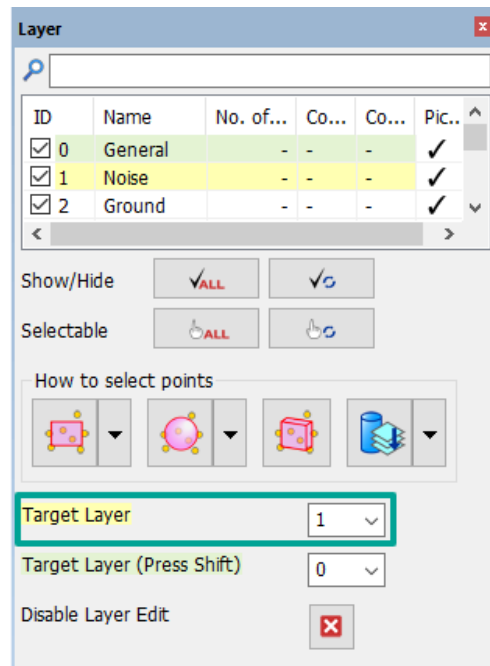


5.3. Removing Noise (Manual Recognition)

1. Select [Pre-process] > [Layer] > [Enable Layer Edit] () from the Ribbon menu.

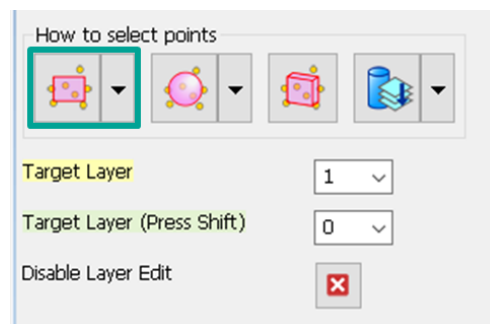


2. [Layer] panel is displayed in editing mode.
Set a layer number for [Target Layer] to specify a layer for moving the noise to.

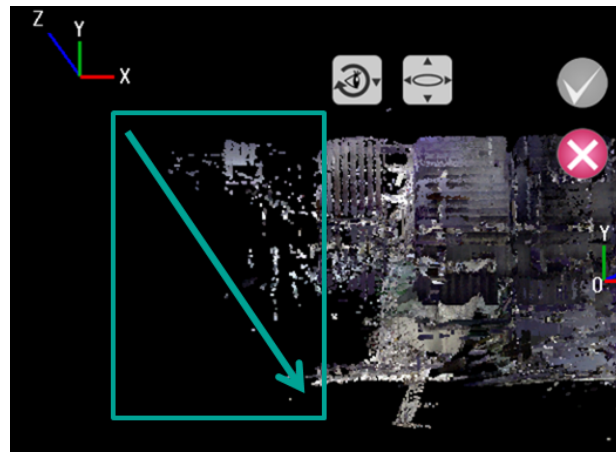


For more details about operation of [Layer] panel, refer to [Layer Editing] in [\[InfiPoints Operation Manual Vol.2 Data Utilization\]](#).

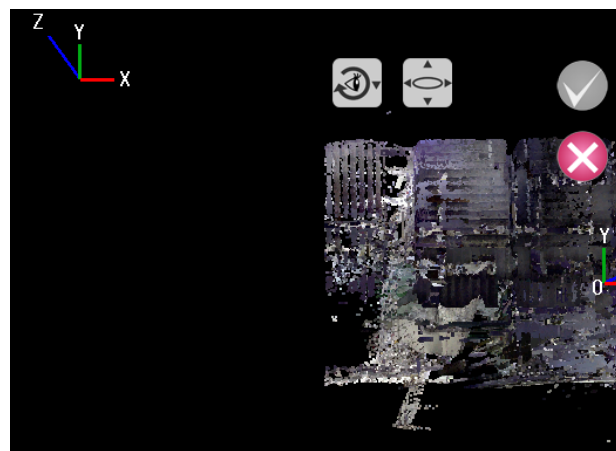
3. In [Layer] panel, press [Rectangle] () from "How to select points".



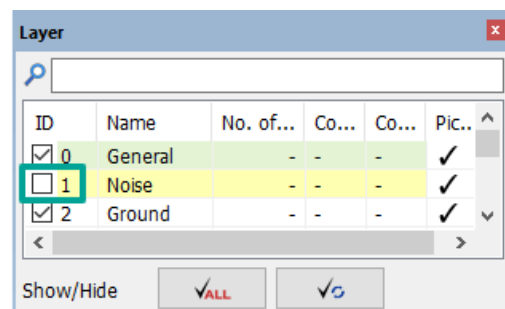
4. Select [Ctrl] key and drag the mouse while clicking on the 3D View Window.



5. The point cloud within the specified area will be moved to the [Target Layer].



If you leave the checkbox of [Target Layer] disabled, it will be hidden when the point cloud moves to [Target Layer].



5.4. [Reference] About Remove Noise

Noise Types

Remove Noise

[Terminologies used in this dialog \(PDF opens in a separate window\)](#)

Noise types to remove (move to another layer)

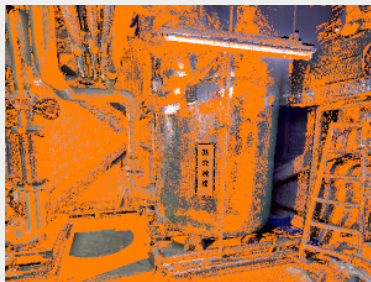
	On/Off	Layer
Too close to the scanner	<input type="button" value="On"/>	3 ▾
Too far from the scanner	<input type="button" value="On"/>	4 ▾
Overlapping noise	<input type="button" value="On"/>	5 ▾
Front noise	<input type="button" value="On"/>	6 ▾
Mixed pixel noise	<input type="button" value="On"/>	7 ▾
Floating noise	<input type="button" value="On"/>	8 ▾

■ Too Close / Too Far

- Points outside the specified [Valid Distance] from the scanner

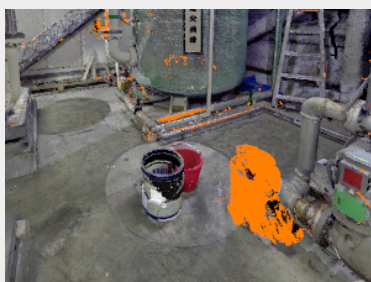
■ Overlapping Noise

- Points overlapping across multiple shots
 - When overlap is detected among thin objects such as walls, the [Overlap distance] setting will be used to maintain thickness.



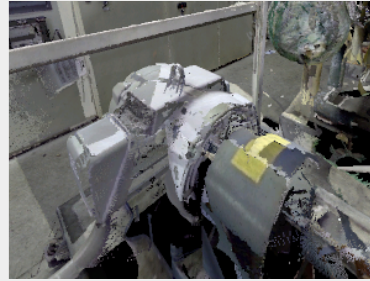
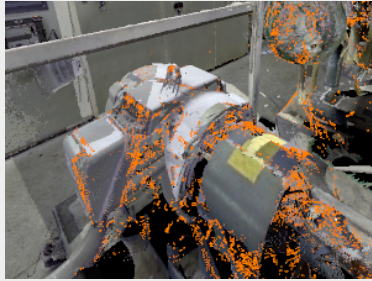
■ Front Noise

- Points scanned accidentally such as moving cars and human figures



■ Mixed Pixel Noise

- Points detected along edges of object such as stretched thread
(Often happens when scanning light angle is acute)



■ Floating Noise

- Points such as dust which is isolated from other points
 - Reduction takes place if the noise is more than the value set in the [threshold number of points for floating objects].



Parameter for Remove Noise

☒ Expand advanced settings

Valid distance from scanner m - m

Overlap distance m

Overlap distance when scanned from both sides m

Valid luminance -

Mixed pixel noise detection Weak Strong

Threshold number of points for floating objects

☒ Hide layers for noise points once completed

☒ Create new point cloud excluding points in hidden and noise layers

■ Valid distance from scanner

This specifies the target area range for noise reduction on overlapping noise and front noise. Points outside of "valid distance" range will be automatically moved to close / distant layers if they were specified in the dialog.

■ Overlap distance

This specifies the distance between points to recognize as "overlapped." When the distance between points is shorter than the specified value, it will be recognized as "overlapped." However, points from several shots taken from 2 opposite sides are not recognized as "Overlapping noise." This allows the objects which thickness is less than "Overlap distance" to keep their thickness as they are.

■ Overlap distance when scanned from both sides

This also specifies the distance between points to recognize as "overlapped," but this is used only on the shots taken from 2 opposite sides. This allows you to perform noise reduction also on thin objects like papers or cloths and show them accurately.

■ Valid luminance

In overlapping noise detection, points in the range of "Valid luminance" are evaluated better than those out of the range.

■ Mixed pixel noise detection

You can adjust the strength of "Mixed pixel noise detection" in 6 levels.

■ Threshold number of points for floating objects

This value specifies upper limit of the number of points to recognize as Floating noise.






■ Hide layers for noise points once completed

After removing the noise, the layer specified as noise will be hidden.

■ Create new point cloud excluding points on invisible and noise layers

You can create a new filtered point cloud data without hidden layers and noise layers.

Supplement: Adequate noise reduction parameters

Items	Adequate Parameters
Valid distance from the scanner	<p>Generally executed with the default value between 0.5m and 30m Used for short/long distance filter tolerance.</p> <p> If the maximum value is decreased, the number of noises detected will decrease also, resulting a reduced process time. This is because overlapping noise and front noise reduction is processed within the valid distance of overlapping scans.</p>
Overlap distance	<p>Generally executed with the default value of 20mm</p> <p> If the registration tolerance is not sufficient, try with a larger value (over 20mm). (Valid luminance will be considered and a higher density value will be applied)</p>
Overlap distance when scanned from both side	<p>Generally execute with the default value of 5mm A parameter used to remove either side of a thin objects' point cloud to avoid insufficient visibility.</p>
Valid luminance	<p>Generally executed with the default value of 0-255 If there is an overlap of high and low luminance, overlapping noise reduction keeps data within the valid luminance.</p> <p> To remove bright overlapping noise such as that of fluorescent light, slightly raise the maximum value of valid luminance.</p>
Mixed pixel noise detection	<p>Change the value depending on the mixed pixel noise amount</p> <p> If there are thread noise around thin objects such as wires, set the detection level at 4 or higher (maximum level if 6).</p>
Threshold number of points for floating objects	<p>Change the value depending on the data</p> <p> If the data is from a scanned factory or plant, 80-120 would be sufficient. In the case of scanned data of outdoor or natural setting, set the level between 10 and 50 to avoid removing excessive floating noise.</p>

6. Extracting Planes and Pipes

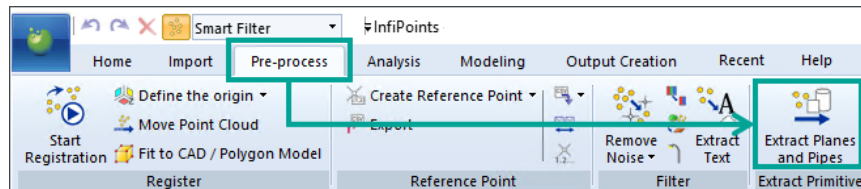
6.1. Auto-extracting Planes and Pipes

Automatically extract planes and pipes from point cloud data. This allows automatic modeling of equipment and pipes.

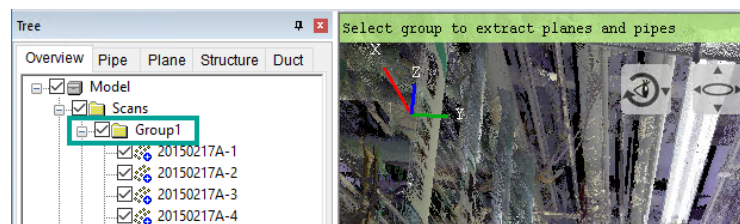


If you want to auto-extract planes and pipes from the point cloud without scan index data, use [Create Point Cloud with Scan Index] () to create the point cloud with scan index data beforehand.

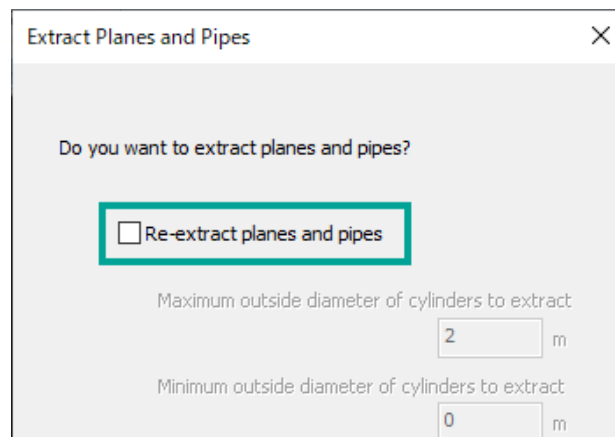
1. Select [Pre-process] tab > [Extract Primitive] > [Extract Planes and Pipes] () from the Ribbon menu.



2. Select the desired point cloud group in [Tree (Overview)] panel.



3. "Extract Planes and Pipes" dialog will appear. If the option "Re-extract planes and pipes" is unchecked and [OK] is clicked, planes and pipes are extracted based on the settings used when the data was import.



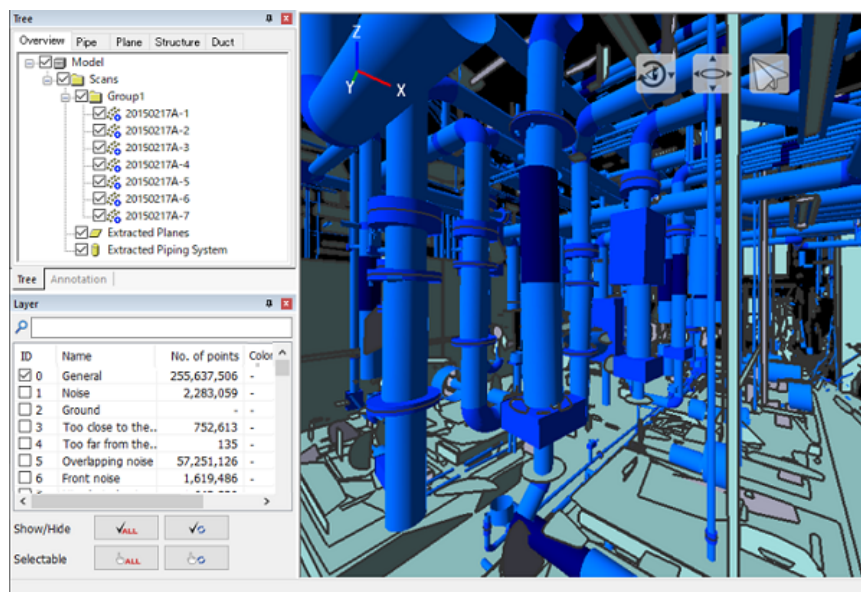


Planes/pipes/spheres are automatically extracted during point cloud import and saved as internal information. Planes and pipes are created based on the saved internal information.

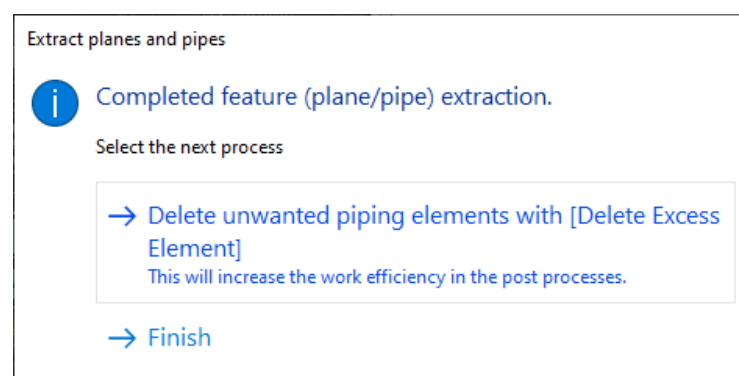


- To re-extract with a different tolerance, enable [Re-extract planes and pipes].
- To classify the extracted planes by the area size, enable [Classify plane groups by area size].

4. Automatically extracted planes and pipes will be displayed on the 3D View Window after completion.





The following dialog will appear.

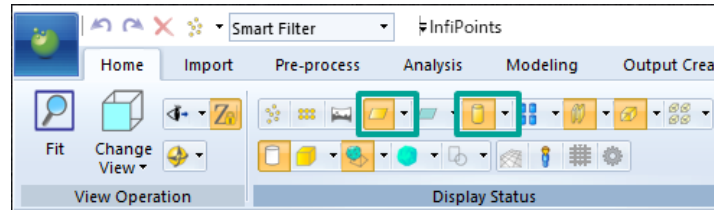


If you would like to delete extracted fine piping automatically, select "Delete unwanted elements with [Delete Excess Element]". Otherwise, select "Finish".





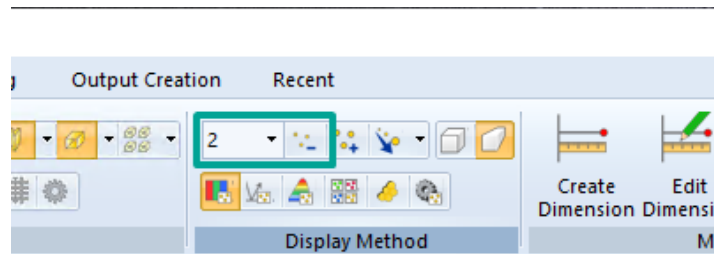
Please refer to "[InfiPoints Operation Manual: Vol.3 Point Cloud Utilization Modeling](#)" > "Pipe Modeling" > "Deleting Pipes" > "Deleting All Excess Pipes" for how to use [Delete Excess Elements].





In case the planes or pipes are not displayed in the "3D View" window, please double-check that [Show Planes] () and [Show Piping Elements] () are enabled at [Home] tab > [Display Status].



Decrease the point cloud display density to more clearly visualize the positional relation between the planes and point cloud data showing simultaneously.

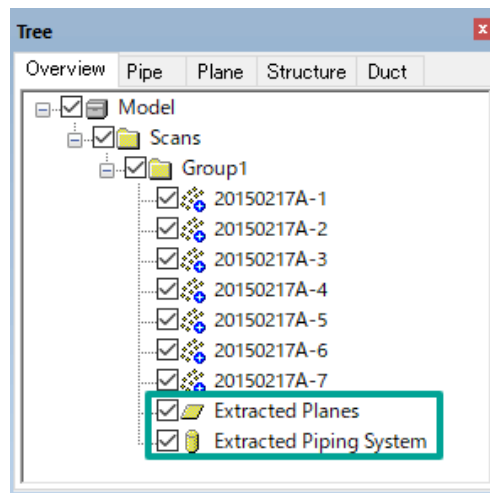
Either select [Reduce Point Density] () from the Ribbon menu or select the appropriate value from the pull down () right beside it.



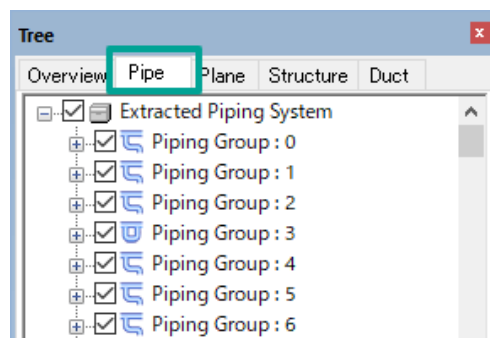
By selecting [Size-adjusted (Round)] (), [Size-adjusted (Square)] (), or [Size-adjusted (Cube)] () as the Point Type, points close to the viewpoint are displayed as enlarged. Or by selecting [Size-fixed] (), all the points are displayed the same size.



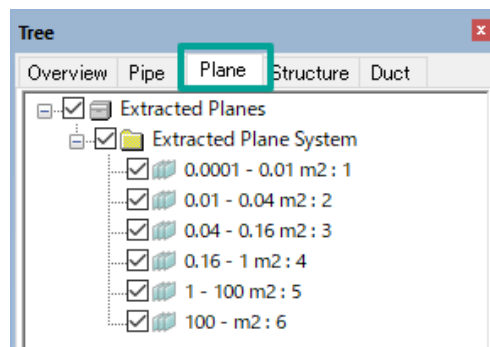
"Extracted Planes" and "Extracted Piping System" are added to the group in [Tree (Overview)] panel.



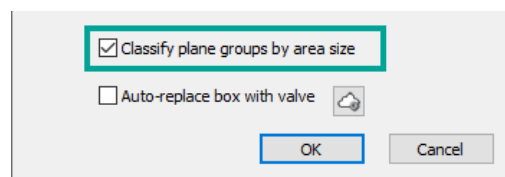
Extracted pipes are displayed in [Tree (Pipe)] panel.



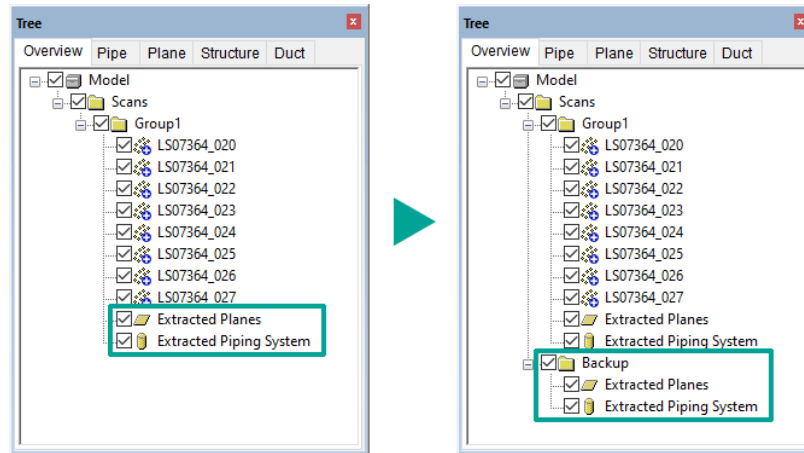
Extracted planes are displayed in [Tree (Plane)] panel.




Please note that only if the option "Classify plane groups by area size" is enabled in "Extract Planes and Pipes" dialog, the extracted planes are classified by size as shown in the image above.



Please note that the existing planes and piping elements will be moved to "Backup" group when running [Extract Planes and Pipes] on the group which already has "Extracted Planes" group and/or "Extracted Piping System" group.



6.2. [Reference] Creating Point Cloud Data with Scan Index


Point cloud without scan index data can be used to generate a point cloud with scan index. The point cloud data with scan index created by this function can now be used to automatically create the plane and piping elements with [\[Extract Planes and Pipes\]](#) ().

Advantages of Creating Point Cloud with Scan Index

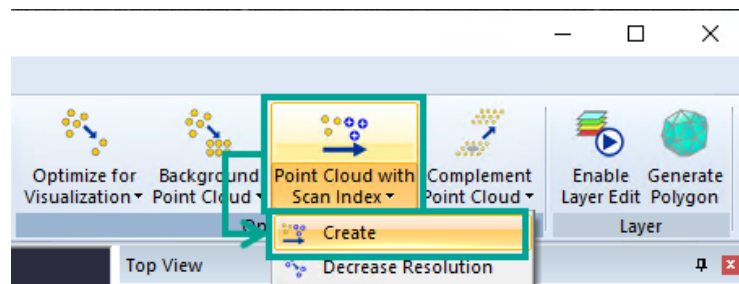
- Auto-extraction of planes and pipes is now possible. Point cloud with scan index was a must before.




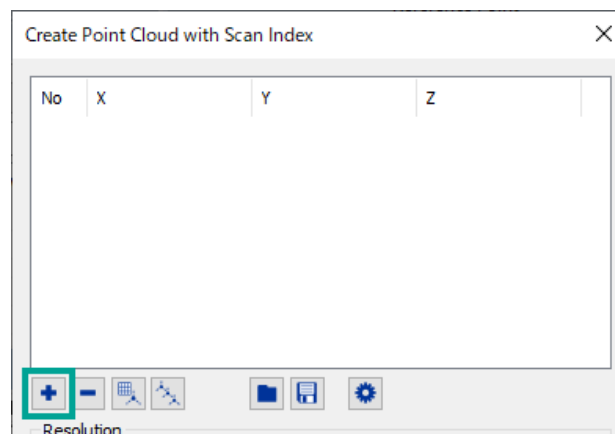
The point cloud data with scan index, which will be used by this function, is assumed to have completed registration process beforehand. Therefore, it is not suitable for auto-registration (by using plane) or noise removal.

Even if you perform [Detect Collision Mode] () on the point cloud data with scan index data created by this function, the result may not be appropriate due to the specification.

1. Select [Pre-process] tab > [Optimize] > [Create Point Cloud with Scan Index] ().




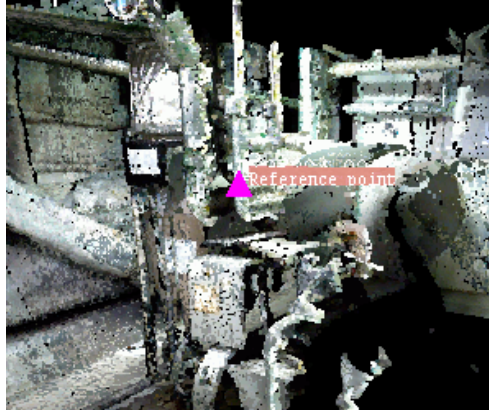
2. "Create Point Cloud with Scan Index" dialog will appear. Press [Add (Define tentative origin (s) by selecting a point)] () at the bottom of the list.





Please note that if you have multiple point cloud parts without scan index data, the above dialog will appear when you select a point cloud part without scan index or a group containing the point cloud part without scan index on [Tree (Overview)] panel.

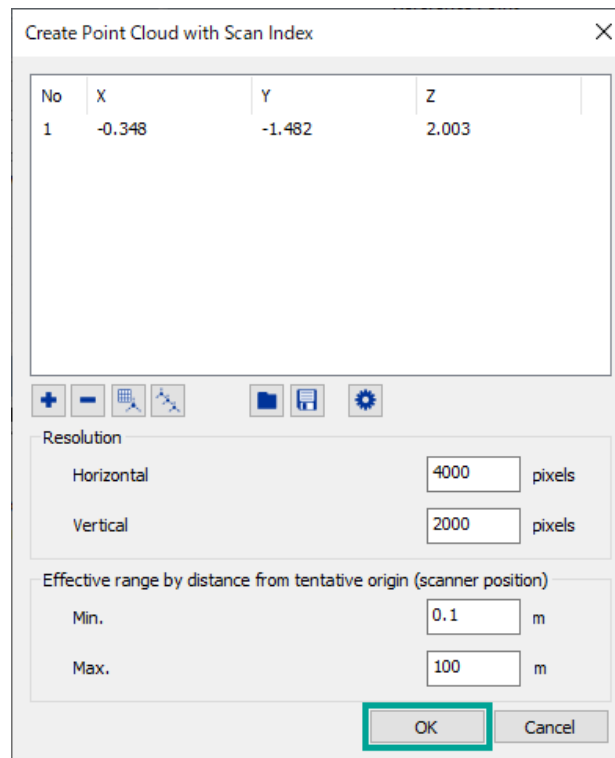
3. Pick a point you want to specify as a tentative origin (virtual scan point) on "3D View" window, and click [Done] ().



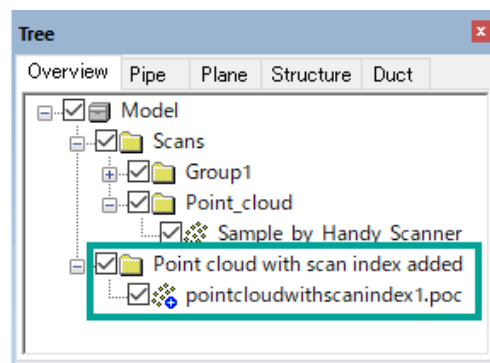
Tentative origin refers to "a hypothetical scanning origin where the scan shots are assumed to be taken". This will become the origin of the point cloud part with scan index data created after execution.


- It is recommended that a tentative origin be set in a position that has been considered scanned by a stationary scanner. In that case, it is recommended that you place as few tentative origins as possible and make sure that there are no blind spots.
- If there are too many tentative origins, the data size will increase. Conversely, if the tentative origins are too few, the number of points that cannot be observed from the tentative origin will increase, leading to a decrease in the number of points included in the created point cloud.

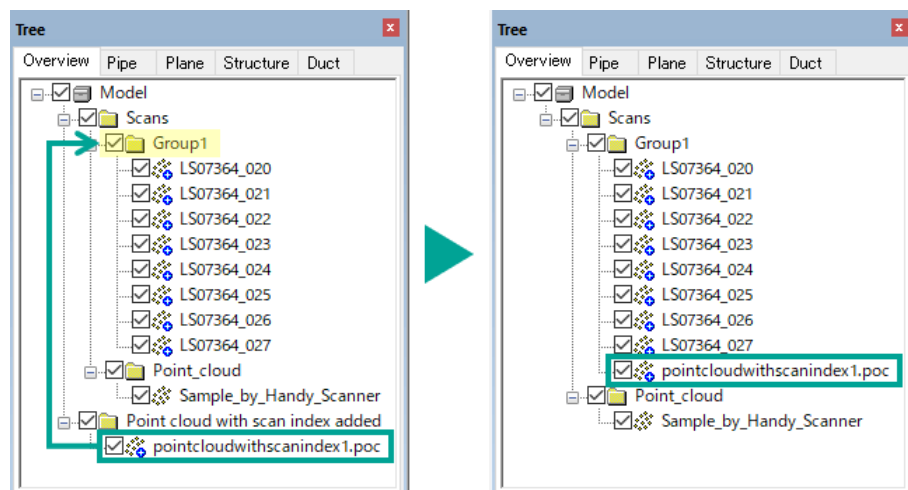
4. In the list of "Create Point Cloud with Scan Index" dialog, the coordinate value of the tentative origin will appear.
In this case, without changing the settings for "Resolution" and "Effective range by distance from tentative origin (scanner position)", click [OK].



Point cloud with scan index data is created.



Please note when executing [Extract Plane and Pipe] () including the newly created point cloud data with scan index, you need to move them to the target group of "Extracted Planes" and "Extracted Piping System".



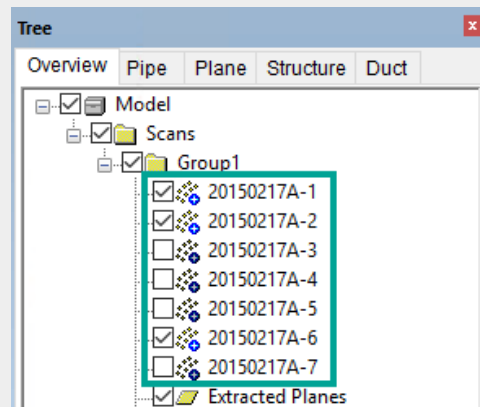
7. Creating Optimal Point Cloud Data for Drawing

Raw point cloud data produced by just scanning is not suitable for drawing because of some reasons, such as the uneven density. Therefore, the view operation of InfiPoints may become heavy.

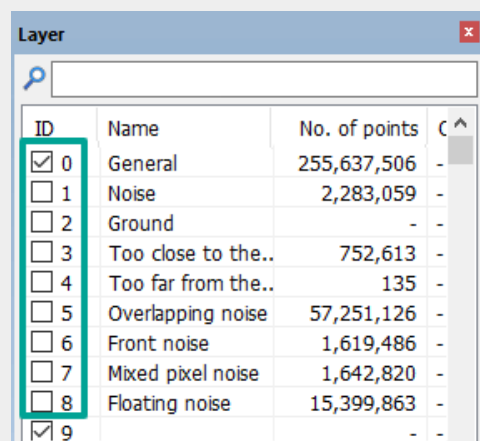
In that case, create point cloud data optimized for visualization to lighten the view operation of InfiPoints.

Preparations for Optimizing Point Cloud Data for Visualization

- Uncheck unnecessary scan shots for the filtered point cloud in [Tree (Overview)] panel.



- Uncheck unnecessary layers for the filtered point cloud in the [Layer] panel.



There are two types of point cloud data optimized for drawing: "Background point cloud data" and "Point cloud data optimized for visualization".

7.1. Creating Background Point Cloud Data


Create a point cloud to be displayed as the background on "3D View" window.

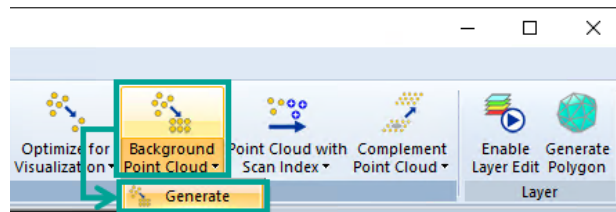
Advantages of Using Background Point Cloud Data

- Enhance the drawing speed by optimizing the point cloud according to the drawing method of InfiPoints.
- Enable displaying just enough information while keeping the project data size at minimum by displaying the point cloud created in another project as the background point cloud.
- Large scale point cloud data can be drawn efficiently.

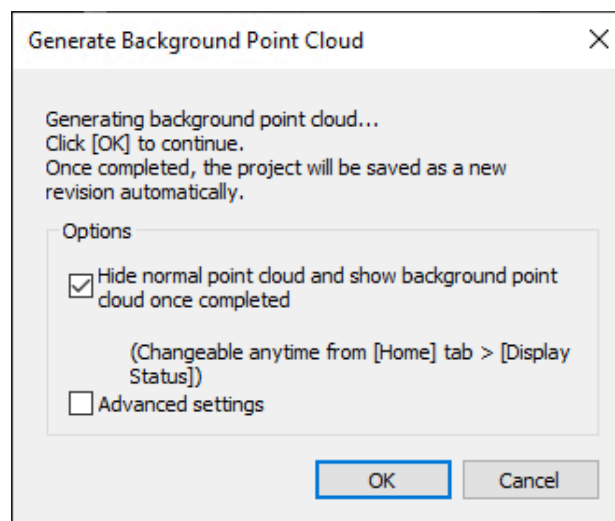


For background point cloud data, it is possible to add dimensions, add notes, and create reference points. Other functions are not available.

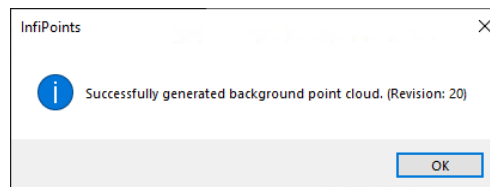
1. Select [Pre-process] tab > [Optimize] > [Background Point Cloud] > [Generate] () from the ribbon menu.



2. "Generate Background Point Cloud" dialog will appear. In this case, click [OK] without changing the default. Creation of background point cloud will start.

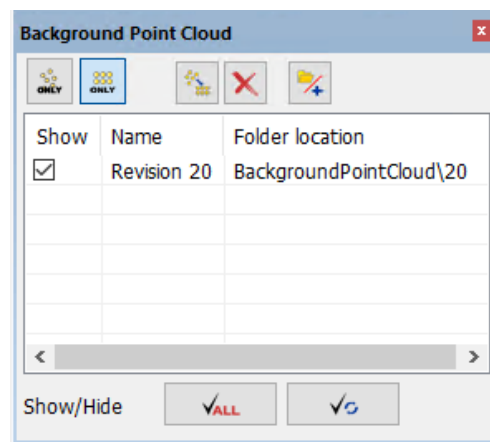




3. When the creation of background point cloud is completed, the following dialog will appear. Click [OK].



After creating the background point cloud, the revision is automatically saved with the comment "Autosaved after generating background point cloud".

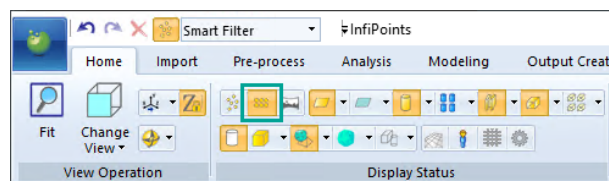
4. Display on "3D View" window switches to show "Background Point Cloud Only", and all the point clouds except the background point cloud are hidden. The created background point cloud can be viewed in [Background Point Cloud] panel.



To switch the display of the background point cloud, press [Show Normal Point Cloud Only] () or [Show Background Point Cloud Only] () in the upper left of [Background Point Cloud] panel.



You can also change from [Home] tab > [Display Status] icons.



The created background point cloud can be displayed as the background of another project.

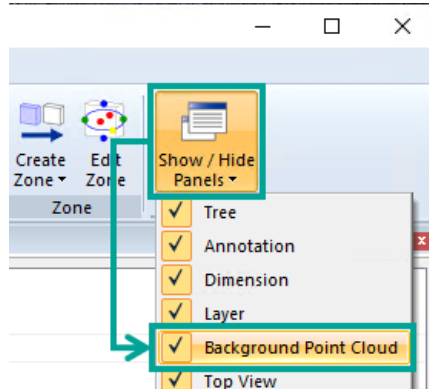



Please note that the background point cloud data is stored inside the automatically created folders with revision numbers, which are located within BackgroundPointCloud folder. BackgroundPointCloud folder is located within the project folder.

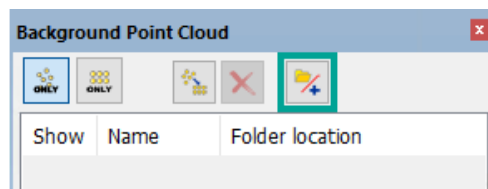
7.2. Importing Background Point Cloud Data

Display the background point cloud data created in another project on "3D View" window.

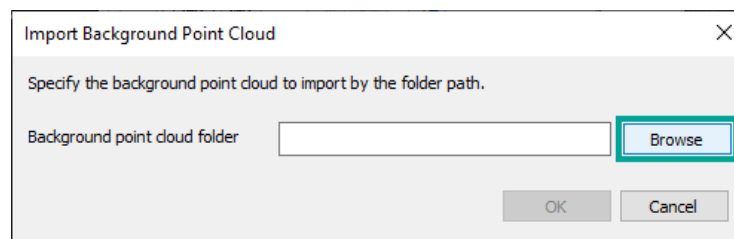
1. Select [Home] tab > [Show/Hide Panels] () and display [Background Point Cloud] panel.



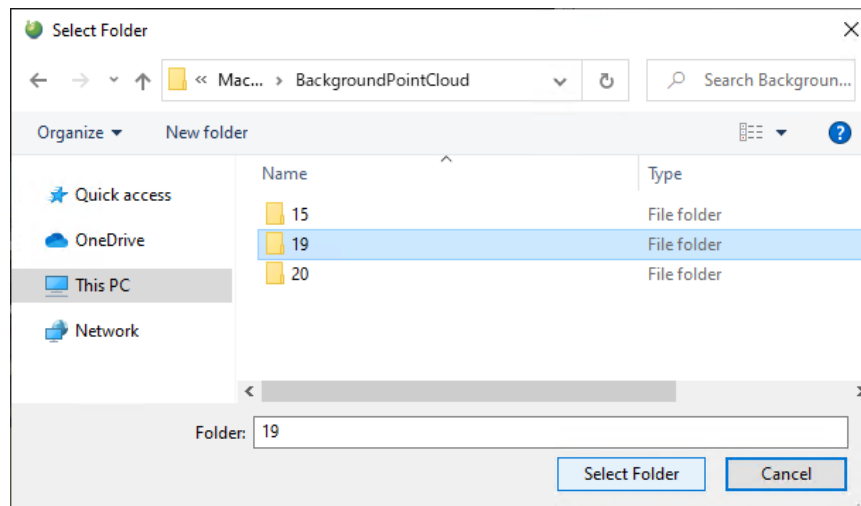
2. Press [Import Background Point Cloud] () at the upper right of [Background Point Cloud] panel.



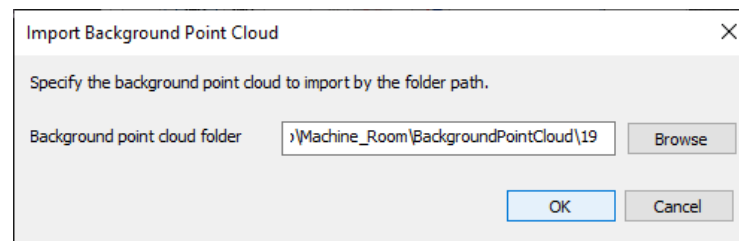
3. "Import Background Point Cloud" dialog will appear. Click [Browse].




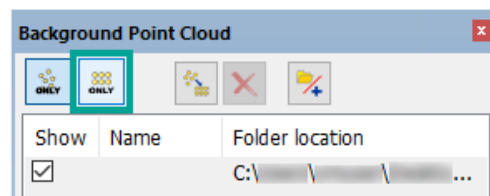
4. "Select Folder" dialog will appear. Specify a folder for the background point cloud data, and then click [Select Folder].



5. You will return to "Import Background Point Cloud" dialog. Click [OK].



6. In [Background Point Cloud] panel, press [Show Background Point Cloud Only] ().
Background point cloud will appear on "3D View" window.



7.3. Creating Point Cloud Data Optimized for Visualization


Advantages of Optimizing Point Cloud Data for Visualization

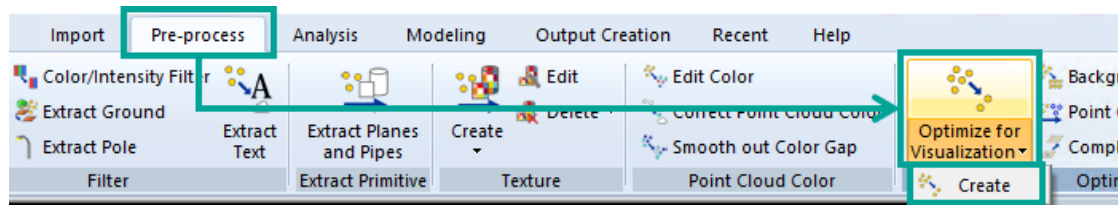
- Data size can be reduced by eliminating unnecessary point clouds.
- Enhance the drawing speed by optimizing the point cloud according to the drawing method of InfiPoints.



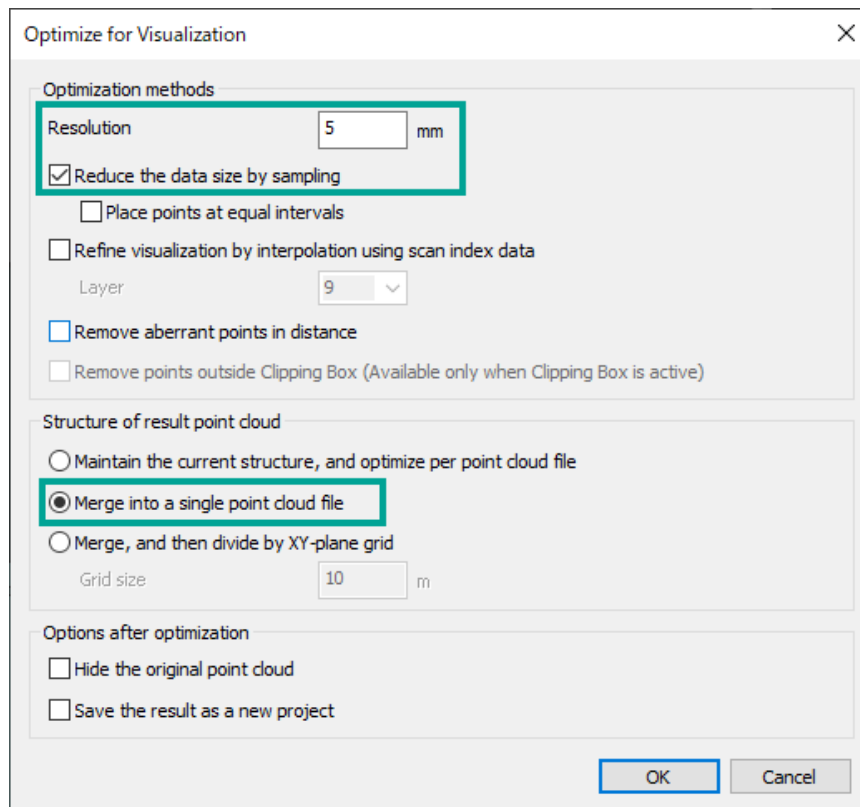
Please note that because the filtered point cloud data do not include any scan index data, some functions such as [Regist Auto ("Register using detected planes")], [Remove Noise], and [Extract Planes and Pipes] cannot be used. Depending on the function you want to use, it may be necessary to switch between the original point cloud and the optimized point cloud.

In this case, to create a lighter data size of point cloud compared to the original point cloud, create point cloud data optimized for visualization by thinning out points.

1. Select [Pre-process] tab > [Optimize] > [Optimize for Visualization] > [Create] () from the ribbon menu.



2. "Optimize for Visualization" dialog will appear. Specify the settings and click [OK].



In general, the following setting is recommended.

- Specify "Resolution" from Optimization methods to place points at equal intervals.
- Check "Reduce the data size by sampling" from Optimization methods.
- Select "Merge into a single point cloud file" from "Structure of result point cloud".



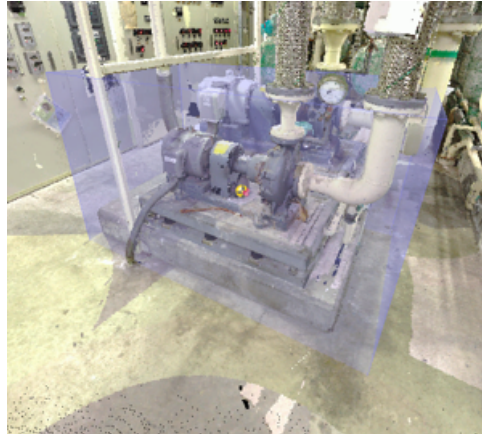
Refer to InfiPoints Help > [Functional Description] > [Pre-process] > [Optimize] > [Optimize for Visualization] for more details about option.



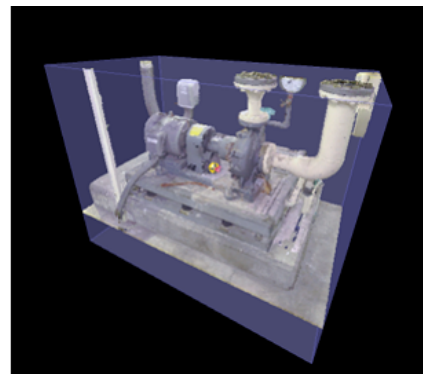
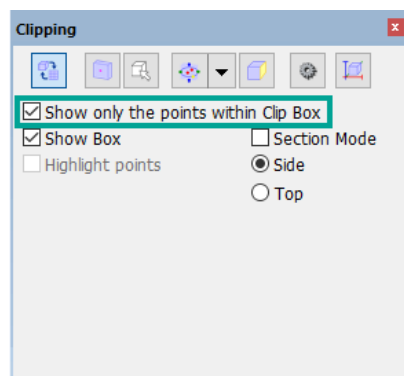
- Please note that when "Reduce the data size by sampling" from Optimization methods is checked, thin out so only one point per interval will remain as specified in "Resolution".
- All target scan shots will be merged into a single point cloud when the "Merge into a single point cloud file" option is selected in "Structure of result point cloud".

It is also possible to create filtered point cloud from the point cloud enclosed within the Clipping Box. The procedure is as follows.

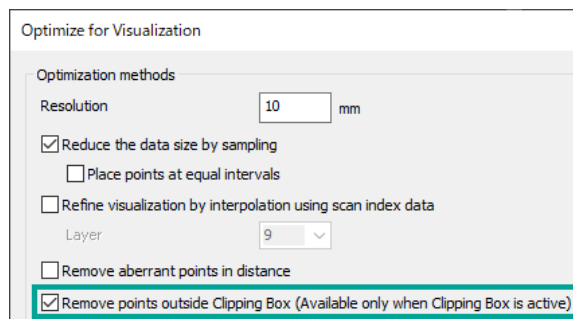
1. Enable [Clipping] panel and enclose only the target point cloud with Clipping Box on "3D View" window.



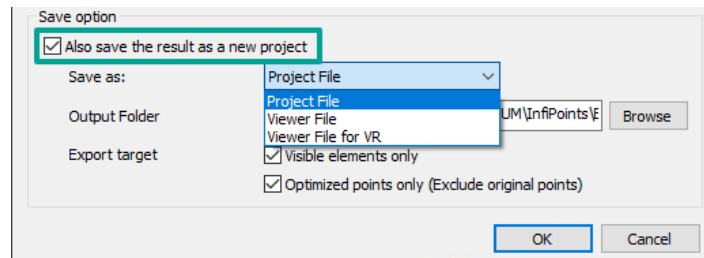
2. In [Clipping] panel, check the option "Hide points outside Clipping Box" to display only the point cloud enclosed within the Clipping Box.



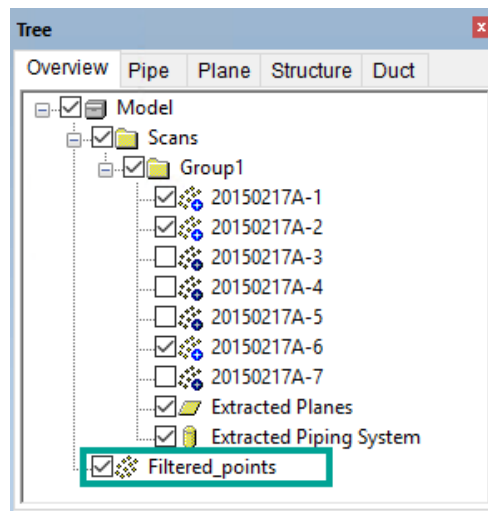
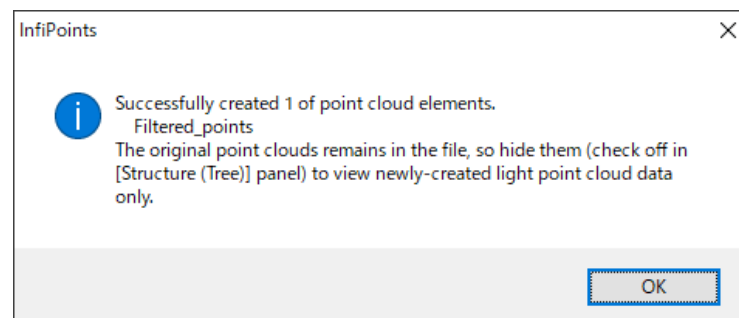
3. Select [Optimize for Visualization] (🔍). In "Optimize for Visualization" dialog, check the option "Remove points outside Clipping Box" and click [OK].



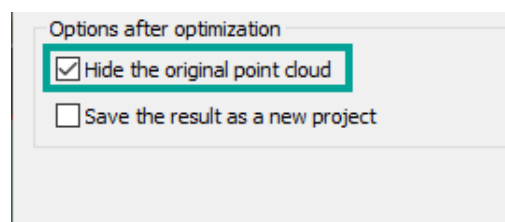
Please note that when "Also save the result as a new project" is checked, another project or viewer file can be created at the same time as creating point cloud data optimized for visualization.



3. Filtered scan shot (Filtered_points) will be created.




To automatically hide the original point cloud when creating the point cloud optimized for visualization (Filtered_points), enable "Hide the original point cloud" and execute.

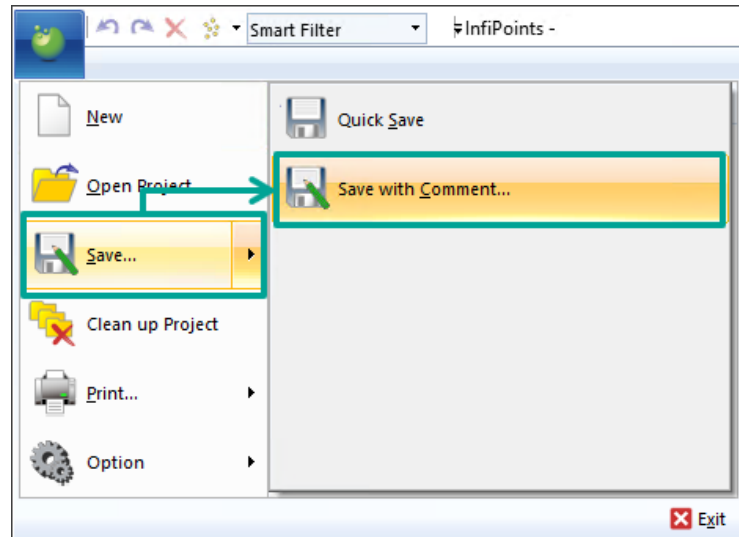


8. Managing Project Data

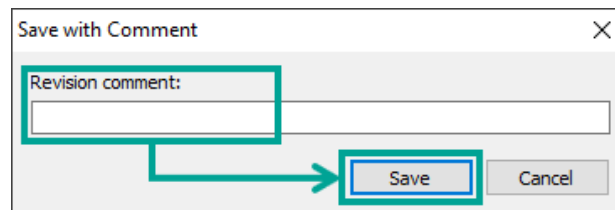
8.1. Saving Projects


InfiPoints stores the editing history as revisions, and the revision number increases as you save it.

1. Select [Application Menu] > [Save With Comment] ().






2. Save With Comment dialog will appear.
Enter the comment for the new revision and click [Save].



Click [Quick Save] () to save a new revision without a comment.



Click [Save with Comment] () to save a new revision including all elements. In this case, the modeling elements are also saved when saving the revision. If there are many modeling elements, it may take time to save.

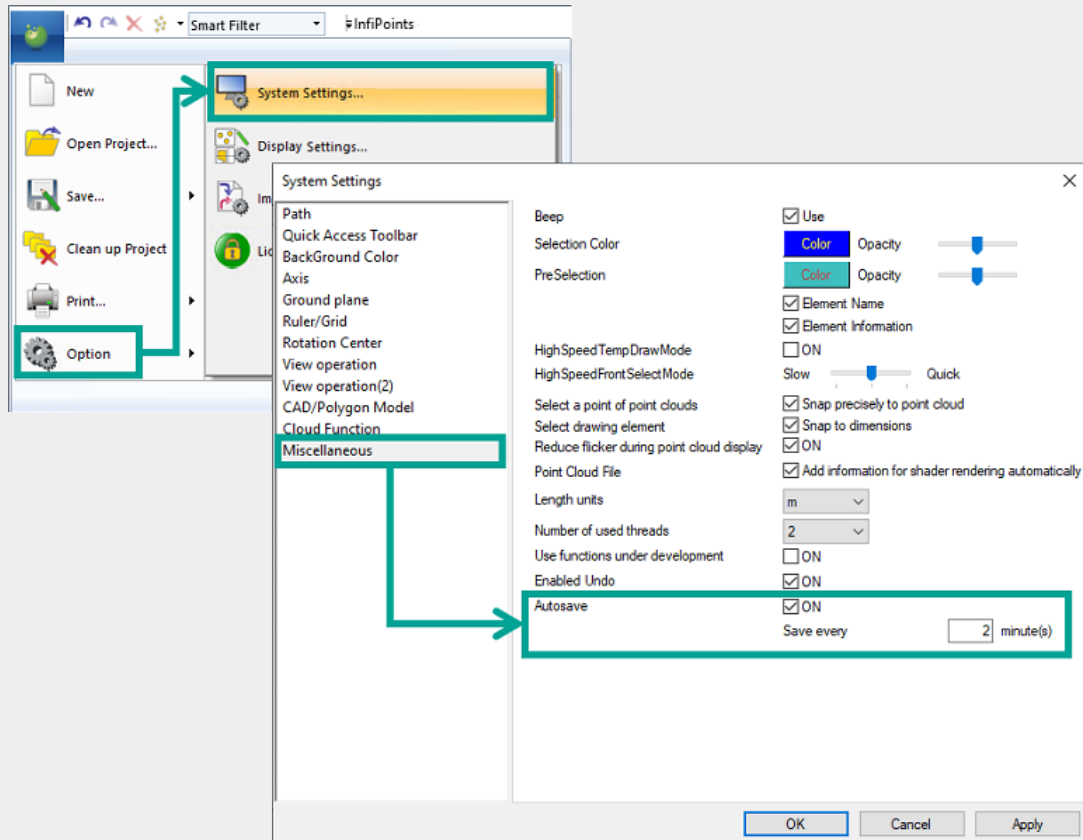
When merging projects including modeling elements by [Project File] (), it is necessary to save revisions using this function. Otherwise, the function [Save with Comment] () is recommended to save the revision.



Please note that once a revision is saved, it cannot be overwritten.

Autosave Project

In "System Settings" dialog, enable "Autosave" option from [Miscellaneous] tab to automatically save revisions with the interval you have set. Autosave will run even if the project on the network share folder is opened.




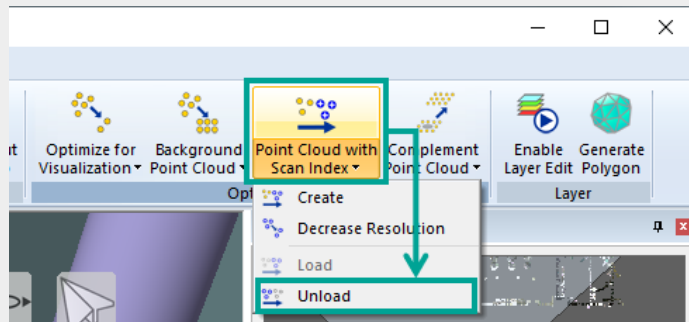
Unload Point Cloud with Scan Index

This is a function to exclude the point cloud with scan index from being loaded into memory when a project is opened. Collision detection data, etc. created from the point cloud with scan index will continue to be read into memory.

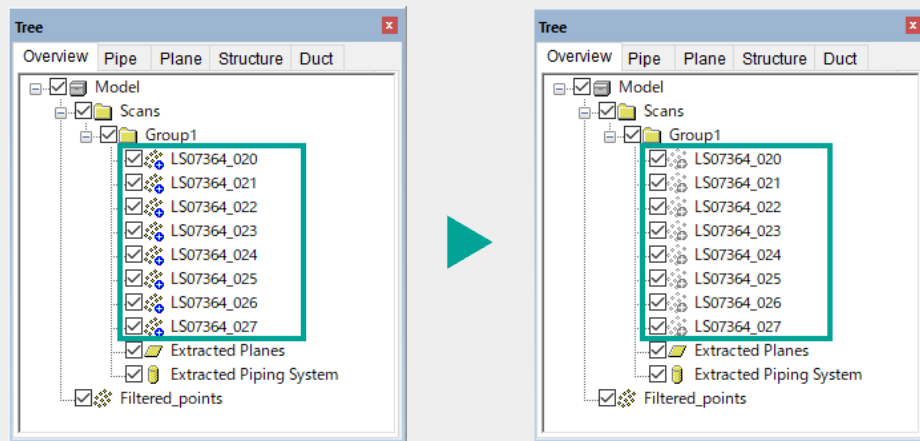
By unloading the point cloud with scan index before exporting, you can reduce the data size of the new project.


■ Steps:

1. Select [Pre-process] tab > [Point Cloud with Scan Index] > [Unload] ().



Point cloud with scan index is unloaded. Unloaded point cloud parts are grayed out on [Tree (Overview)] panel.



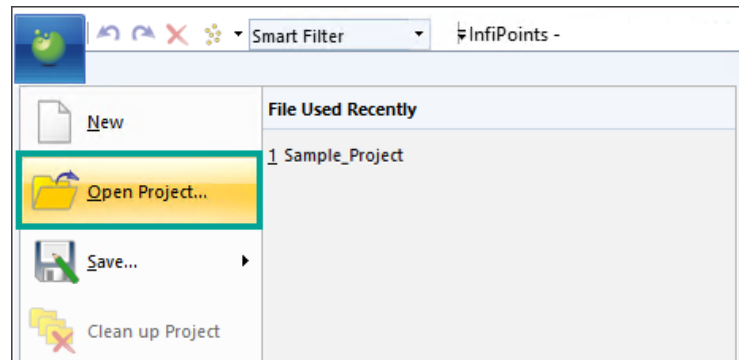
Please note that you can reload the unloaded point cloud with scan index with [Point Cloud with Scan Index] > [Load] ().



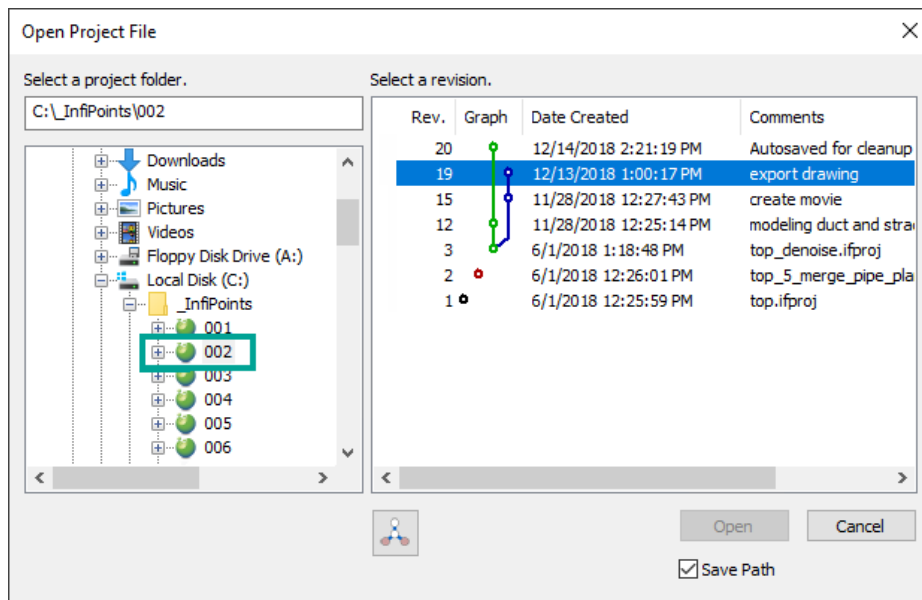
You cannot load point cloud with scan index from a project that was exported excluding the point cloud with scan index.

8.2. Opening Projects

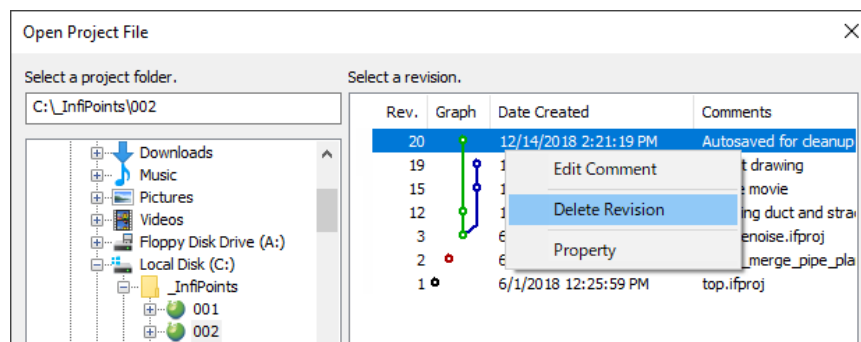
1. Select [Application Menu] > [Open Project] ().



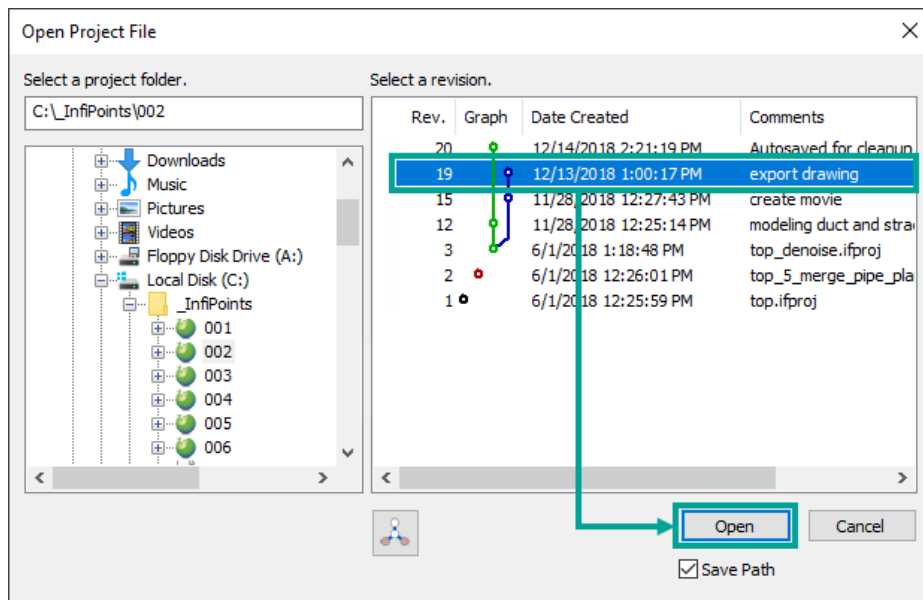
2. Open Project File dialog will be displayed.
Specify the project folder in the left pane of the dialog. The list of Revisions will be displayed in the right pane of the dialog.



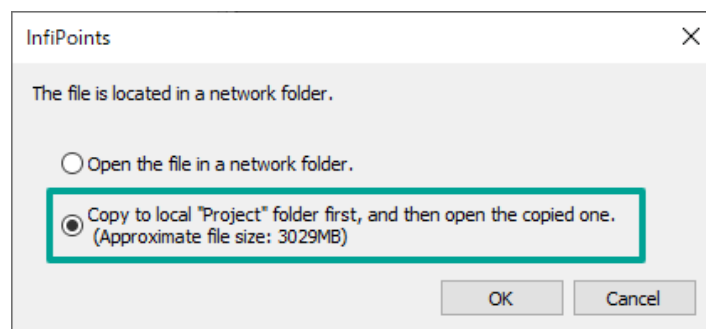
Right-click on a revision to edit its comment, to delete that revision, etc. from the context menu.



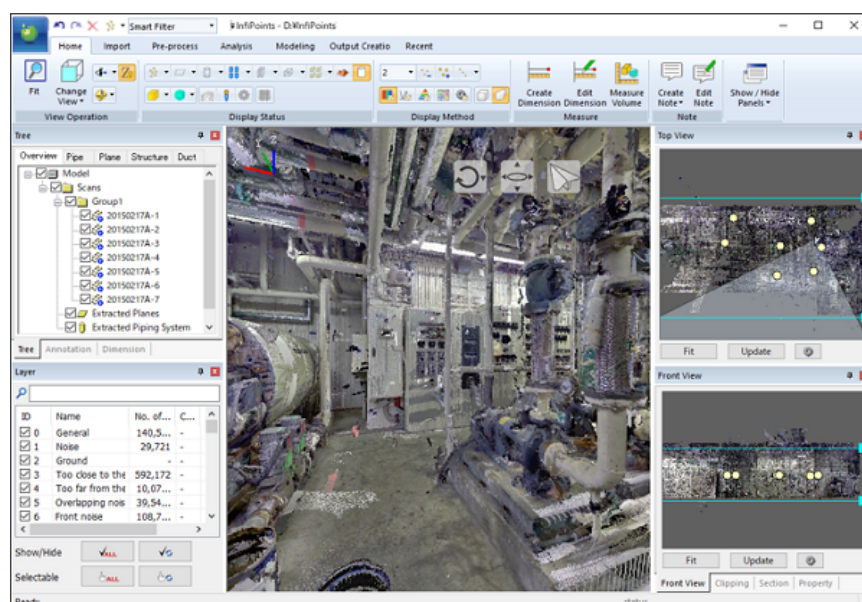
3. Specify a Revision from the list and click [Open].



Please note that when a revision of a project on the network drive is specified, the following dialog will appear. A project on the network drive can directly be opened. However, there may be a delay when trying to display drawings. It is recommended to select "Copy to local Project folder first, and then open the copied one" to open a project.




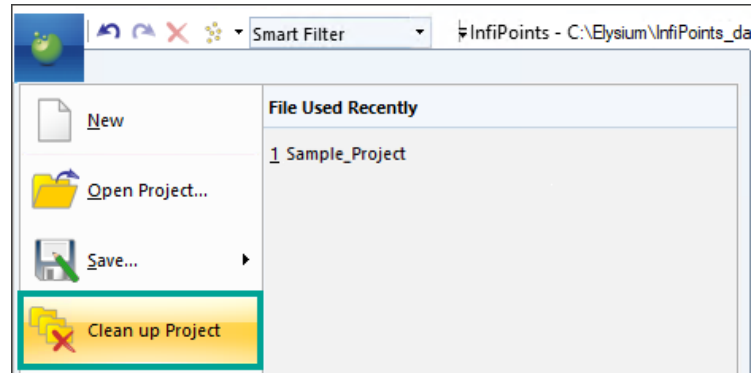
Selected Revision will open.



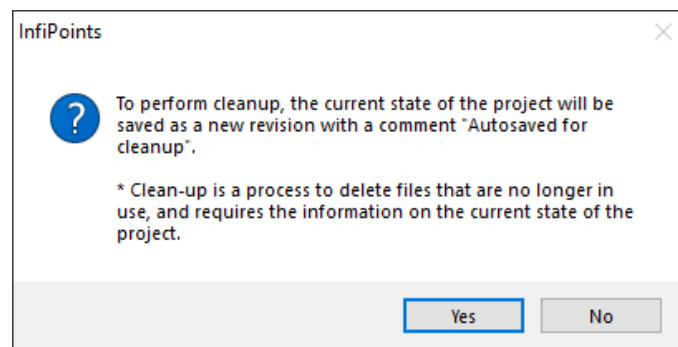
8.3. Cleaning up Project Data

This is a command to reduce the data size of the project folder by deleting unnecessary Revisions and/or files.

1. Select [Application Menu] > [Clean up Project] ().

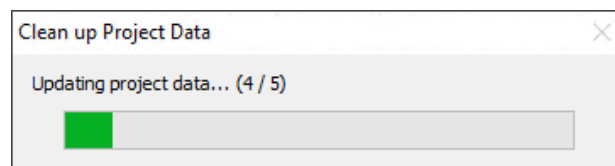


A confirmation dialog will appear.

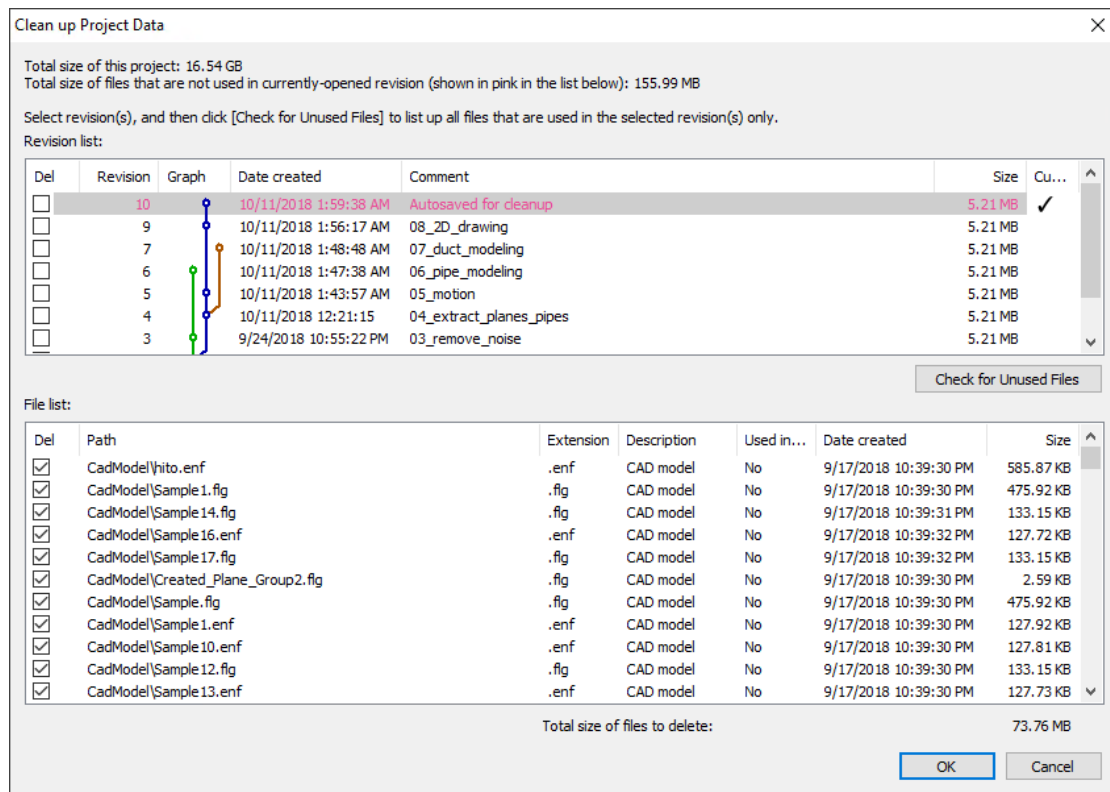


This dialog will only appear when the project needs to be updated.

2. Click [Yes] in the dialog to save the Revision in the state before executing the clean up.



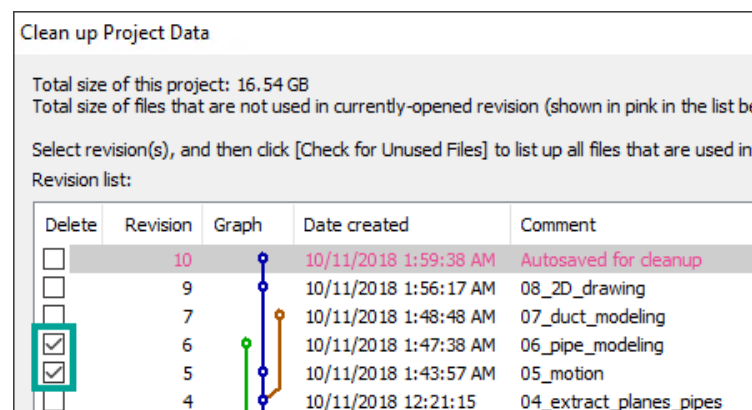
3. Once the autosave is completed, "Clean up Project Data" dialog will appear.




About the "Clean up Project Data" dialog

- In the "Clean up Project Data" dialog, "Revision list" is displayed in the upper part, and "File list" is displayed in the lower part.
- Files that are not referenced by any Revision are initially checked on.
- Files referenced only by currently opened Revision are not displayed in the "File list."
- "Total size of files to delete" at the lower right of the dialog will be updated when the check box is checked/checked off.

4. Check Revision(s) to delete in the "Revision list."



- Selecting any Revision in the "Revision list" highlights the files referenced by the selected Revision in the "File list" by yellow.



Revision list:						
Del	Revision	Graph	Date created	Comment	Size	Currently opened
<input type="checkbox"/>	9		10/11/2018 1:56:17 AM	08_2D_drawing	5.21 MB	
<input type="checkbox"/>	7		10/11/2018 1:48:48 AM	07_duct_modeling	5.21 MB	
<input type="checkbox"/>	6		10/11/2018 1:42:39 AM	05_pipe_modeling	5.21 MB	
<input type="checkbox"/>	5		10/11/2018 1:43:57 AM	05_motion	5.21 MB	
<input type="checkbox"/>	4		10/11/2018 12:21:15 AM	04_extract_planes_pipes	5.21 MB	
<input type="checkbox"/>	3		9/24/2018 10:55:22 PM	03_remove_noise	5.21 MB	
<input type="checkbox"/>	2		2/18/2018 5:32:33 PM	02_registration_auto	5.20 MB	

File list:						
Del	Path	Extension	Description	Used in...	Date created	Size
<input checked="" type="checkbox"/>	PointCloud\YOMEP3184332_9680_20		Point cloud	No	9/20/2018 12:52:48 AM	64.00 KB
<input checked="" type="checkbox"/>	PointCloud\YOMEP2453000_9680_70		Point cloud	No	9/20/2018 12:40:36 AM	64.00 KB
<input checked="" type="checkbox"/>	PointCloud\YOMEP3338612_9680_14		Point cloud	No	9/20/2018 12:55:22 AM	9.59 MB
<input type="checkbox"/>	CadValidation\Extracted Planes_b34ed181-9ce7-4188-b2b6-3c1065d...	.txt	CAD validation	Yes(Ca...	9/17/2018 10:39:41 PM	32.34 MB
<input type="checkbox"/>	CadValidation\Extracted Planes_b34ed181-9ce7-4188-b2b6-3c1065d...	.txt	CAD validation	Yes(Ca...	9/17/2018 10:39:43 PM	3.08 MB
<input checked="" type="checkbox"/>	Drawing\Cylinder.Axis.dwg	.dwg	Drawing	No	9/17/2018 10:39:43 PM	93.38 KB
<input checked="" type="checkbox"/>	Drawing\Cylinder.Axis1.dwg	.dwg	Drawing	No	9/17/2018 10:39:43 PM	88.88 KB
<input checked="" type="checkbox"/>	Drawing\Cylinder.Axis2.dwg	.dwg	Drawing	No	9/17/2018 10:39:44 PM	95.10 KB
<input checked="" type="checkbox"/>	Drawing\Drawing1.dwg	.dwg	Drawing	No	9/17/2018 10:39:44 PM	11.86 KB
<input checked="" type="checkbox"/>	Drawing\Drawing10.dwg	.dwg	Drawing	No	9/17/2018 10:39:44 PM	11.75 KB
<input checked="" type="checkbox"/>	Drawing\Drawing11.dwg	.dwg	Drawing	No	9/17/2018 10:39:44 PM	9.71 KB

- Selecting any file in the "File list" highlights the Revisions referenced by the selected file in the "Revision list" by green.

Revision list:						
Del	Revision	Graph	Date created	Comment	Size	Currently opened
<input type="checkbox"/>	13		10/11/2018 2:08:19 AM		5.22 MB	
<input type="checkbox"/>	9		10/11/2018 1:56:17 AM	08_2D_drawing	5.21 MB	
<input type="checkbox"/>	7		10/11/2018 1:48:48 AM	07_duct_modeling	5.21 MB	
<input type="checkbox"/>	6		10/11/2018 1:47:38 AM	06_pipe_modeling	5.21 MB	
<input type="checkbox"/>	5		10/11/2018 1:43:57 AM	05_motion	5.21 MB	
<input type="checkbox"/>	4		10/11/2018 12:21:15 AM	04_extract_planes_pipes	5.21 MB	
<input type="checkbox"/>	3		9/24/2018 10:55:22 PM	03_remove_noise	5.21 MB	

File list:						
Del	Path	Extension	Description	Used in...	Date created	Size
<input checked="" type="checkbox"/>	PointCloud\YOMEP3184332_9680_20226_0		Point cloud	No	9/20/2018 12:52:48 AM	64.00 KB
<input checked="" type="checkbox"/>	PointCloud\YOMEP2453000_9680_7061_0		Point cloud	No	9/20/2018 12:40:36 AM	64.00 KB
<input checked="" type="checkbox"/>	PointCloud\YOMEP3338612_9680_14497_0		Point cloud	No	9/20/2018 12:55:22 AM	9.59 MB
<input type="checkbox"/>	CadValidation\Extracted Planes_b34ed181-9ce7-4188-b2b6-3c1065d...	.txt	CAD validation	Yes(Ca...	9/17/2018 10:39:41 PM	32.34 MB
<input type="checkbox"/>	CadValidation\Extracted Planes_b34ed181-9ce7-4188-b2b6-3c1065d...	.txt	CAD validation	Yes(Ca...	9/17/2018 10:39:43 PM	3.08 MB
<input checked="" type="checkbox"/>	Drawing\Cylinder.Axis.dwg	.dwg	Drawing	No	9/17/2018 10:39:43 PM	93.38 KB
<input checked="" type="checkbox"/>	Drawing\Cylinder.Axis1.dwg	.dwg	Drawing	No	9/17/2018 10:39:43 PM	88.88 KB
<input checked="" type="checkbox"/>	Drawing\Cylinder.Axis2.dwg	.dwg	Drawing	No	9/17/2018 10:39:44 PM	95.10 KB
<input checked="" type="checkbox"/>	Drawing\Drawing1.dwg	.dwg	Drawing	No	9/17/2018 10:39:44 PM	11.86 KB
<input checked="" type="checkbox"/>	Drawing\Drawing10.dwg	.dwg	Drawing	No	9/17/2018 10:39:44 PM	11.75 KB
<input checked="" type="checkbox"/>	Drawing\Drawing11.dwg	.dwg	Drawing	No	9/17/2018 10:39:44 PM	9.71 KB

- By clicking [Check for Unused Files], the check box of the files referenced only by the Revisions whose check boxes are turned On in the "Revision list" will be On.

Extension	Description	Used in...	Date created	Size
.poc	Point cloud	No	9/20/2018 12:55:08 AM	9.68 MB
.poc_la	Point cloud	No	9/20/2018 12:55:08 AM	9.70 KB

- Click [OK] to delete Revisions and files that are checked in the revision and file lists.

.dwg	Drawing	No	9/17/2018 10:39:44 PM	11.33 KB
.dwg	Drawing	No	9/17/2018 10:39:44 PM	11.40 KB
.dwg	Drawing	No	9/17/2018 10:39:44 PM	11.36 KB
.dwg	Drawing	No	9/17/2018 10:39:44 PM	12.86 KB

Total size of files to delete: 73.76 MB

8.4. Merging Project Data

Multiple project data can be merged into one project data.

For example, you can gather the project data that were worked on separately, and merge all the project data into one after the work is completed.

This command can merge the following:

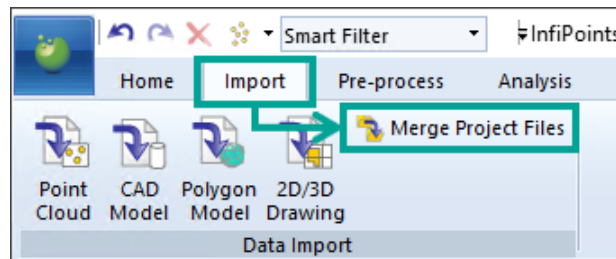


- Point Cloud
- Reference point
- Modeling elements (Planes / Pipes / Structures / Ducts) ... InfiPoints version 6.0 or later

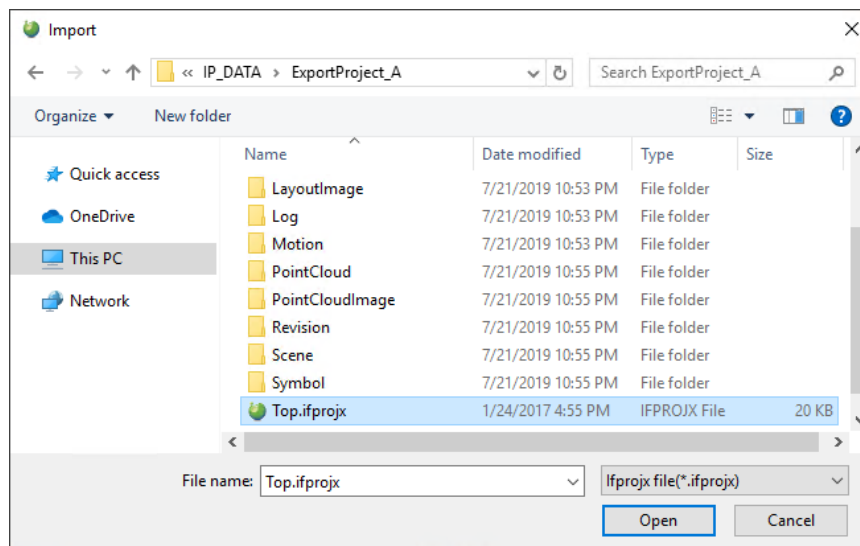


Please note that when merging the projects including modeling elements, specify the project which is exported by [Save with Comment] ().

1. Select [Import] tab > [Data Import] > [Merge Project Files] () from the Ribbon menu.




2. "Import" dialog will appear. Specify the project file (Top.ifprojx) to import, and click [Open].

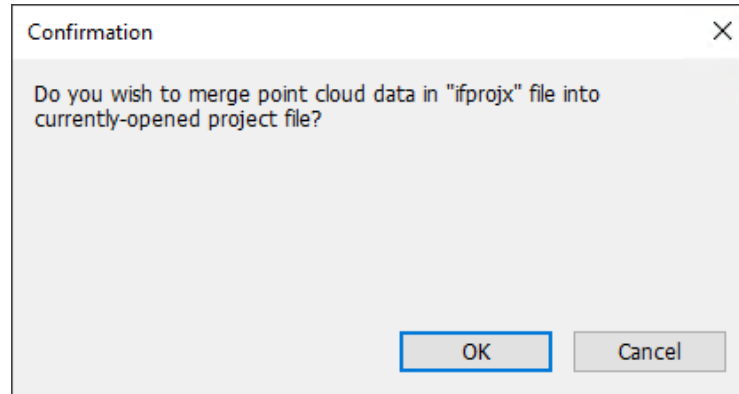




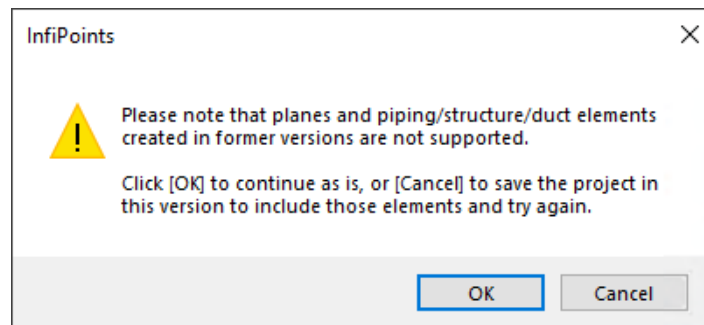
Please note that you cannot specify a particular revision. Elements included in the last opened revision will be imported.

If you want to import a particular revision, it is recommended to prepare another project in advance from [Output Creation] tab > [Project File] ().

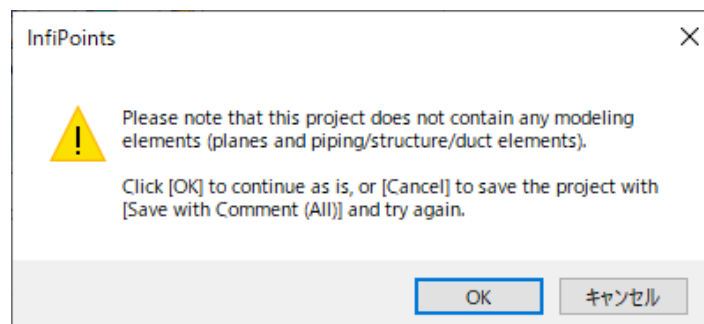
3. A "Confirmation" dialog will appear. Click [OK].



When importing a project created with versions before InfiPoints 6.0, the modeling elements will not be imported.



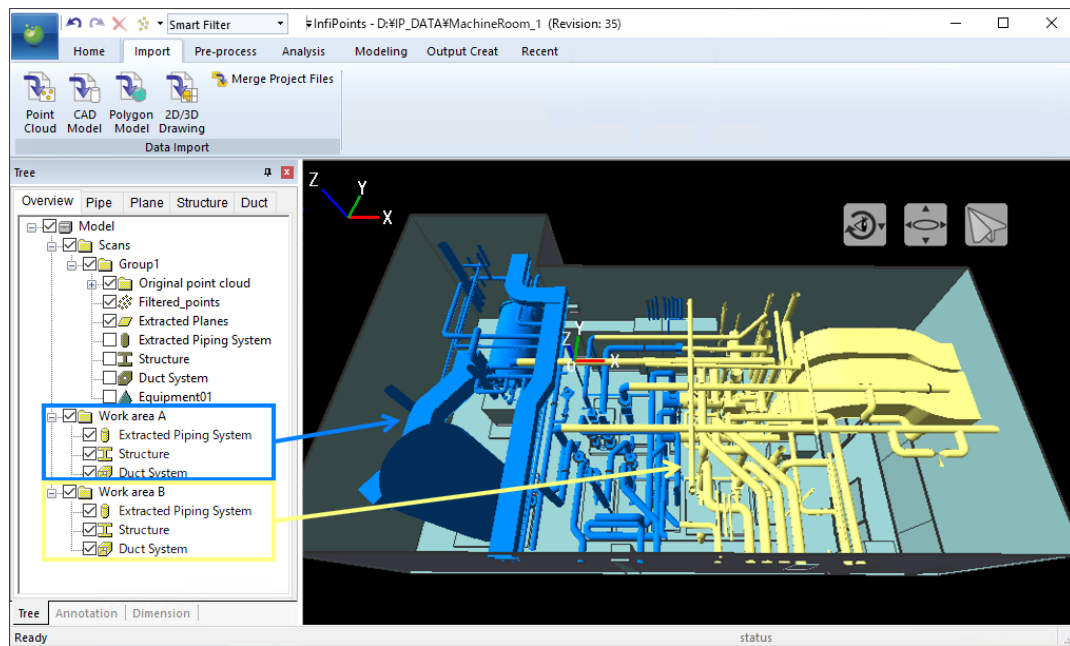
When specifying a project file (Top.ifprojx) which does not include modeling elements, the following dialog will appear.



Specified project will be imported.

Each element of the currently opened project and another imported project is divided into separate groups.

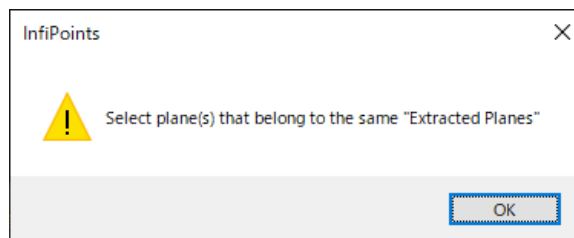
- Image of a merged project



Please note that the display status for modeling elements is not reflected when imported. All modeling elements will be displayed regardless of the original display status when imported. It is recommended to delete unnecessary modeling elements before importing.

Please note that when editing the modeling elements after merging the projects, the following dialog may appear.

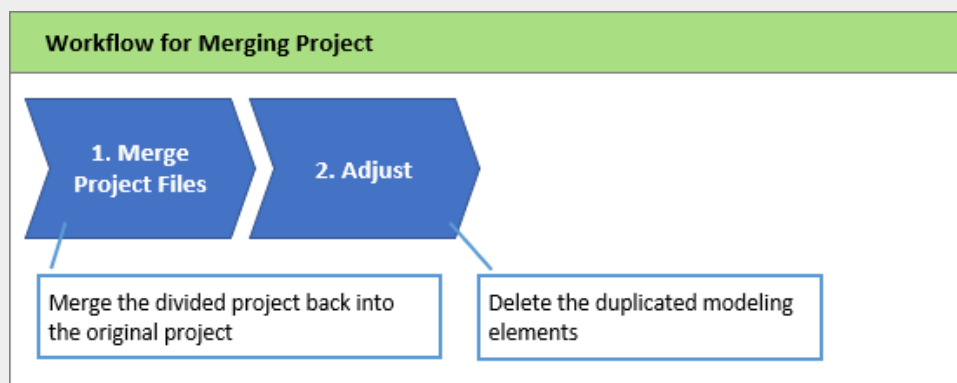
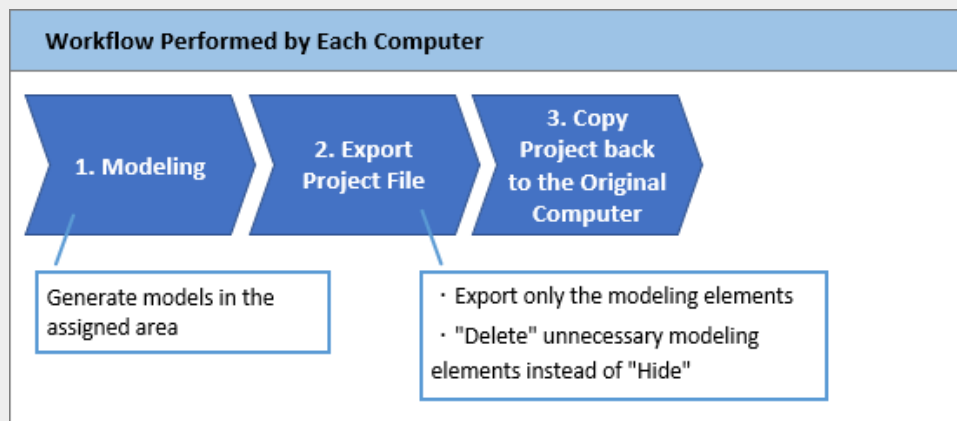
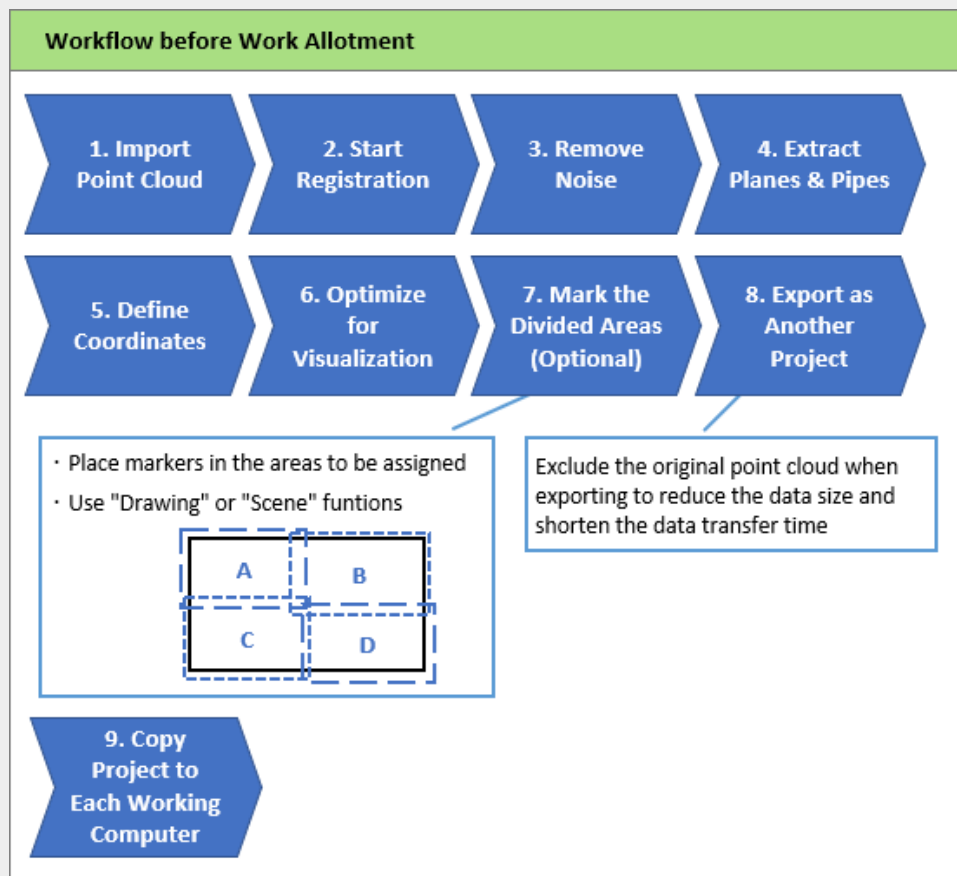
(Example) When Plane Modeling



This is because the groups of modeling elements to edit are different. Copy each modeling element to the same part at once (Extracted Planes/ Extracted Piping System/Structure/Duct System) and then edit the modeling element.

Please refer to [Plane Modeling], [Pipe Modeling], [Structure Modeling], and [Duct Modeling] in "InfiPoints Operation Manual Vol.3 Point Cloud Utilization Modeling" for more details about how to copy planes, pipes, structures, and ducts.

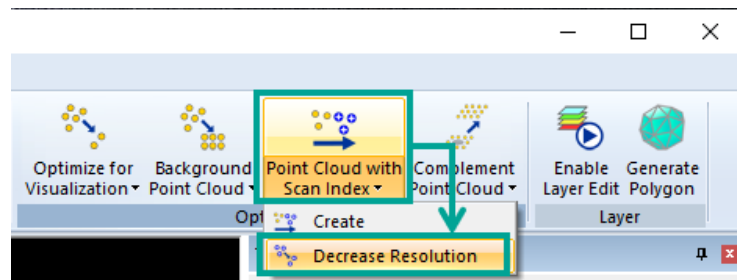
- Workflow when dividing and working on a project (Example)



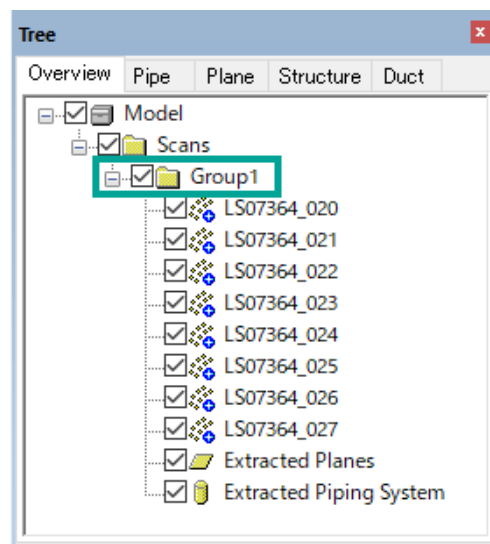
8.5. Reducing the Data Size of Point Cloud with Scan Index

While retaining the scan index, the data size can be reduced by lowering the density point cloud.

1. Select [Pre-process] tab > [Point Cloud with Scan Index] > [Decrease Resolution] ().

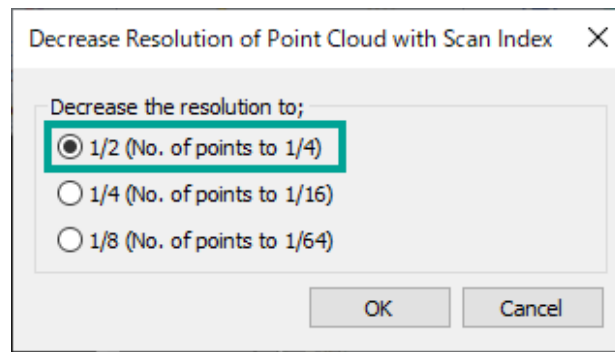


2. In [Tree (Overview)] panel, specify the group that includes the point cloud with scan index which you wish to reduce the size.

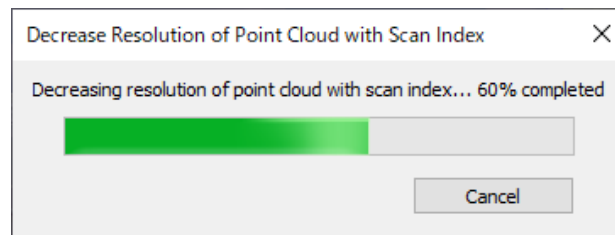


If the specified group contains point clouds without scan index, those without are excluded from the process. When decreasing the resolution of the point clouds, those without scan index within the group will be ignored.

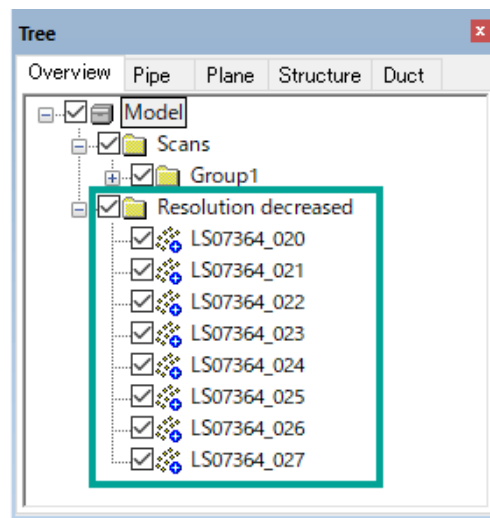
3. "Decrease Resolution of Point Cloud with Scan Index" dialog will appear. In this case, select the resolution as "1/2 (No. of points to 1/4)" and click [OK].



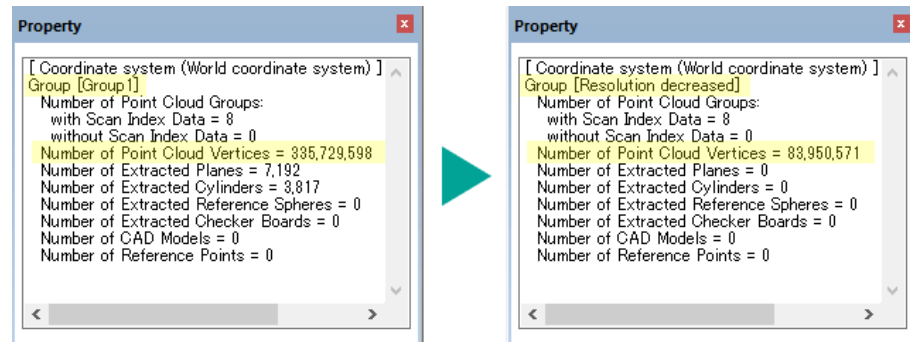
The process of decreasing the resolution of point cloud with scan index will start. Progress status can be seen in the progress bar.



When the process is completed, a newly decreased resolution point cloud with scan index data is created.



In this case, the resolution is reduced by 1/2 in both the height and width directions, so the number of points in the new decreased resolution point cloud (lower right figure) is reduced to approximately 1/4 compared to the number of points in the source point cloud (lower left figure).



When you want to reduce the data size of your project, it is recommended to output it as a separate project with only the decreased resolution of point cloud with scan index displayed.



Please refer to [Exporting Files] > [Exporting Projects] of "InfiPoints Operation Manual: Vol.2 Point Cloud Utilization Simulation & Data Utilization" for details about exporting projects.

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